ES-3124 Series

Intelligent Layer 2+ Switch

User's Guide

Version 3.80
8/2007
Edition 1

DEFAULT LOGIN	
In-band IP Address	**http://192.168.1.1**
Out-of-band IP Address	**http://192.168.0.1**
User Name	**admin**
Password	**1234**

ZyXEL

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the Switch using the web configurator. You should have at least a basic knowledge of TCP/IP networking concepts and topology.

Related Documentation

- Web Configurator Online Help
  Embedded web help for descriptions of individual screens and supplementary information.
- Command Reference Guide
  The Command Reference Guide explains how to use the Command-Line Interface (CLI) and CLI commands to configure the Switch.



It is recommended you use the web configurator to configure the Switch.

- Supporting Disk
  Refer to the included CD for support documents.
- ZyXEL Web Site
  Please refer to www.zyxel.com for additional support documentation and product certifications.

User Guide Feedback

Help us help you. Send all User Guide-related comments, questions or suggestions for improvement to the following address, or use e-mail instead. Thank you!

The Technical Writing Team,
ZyXEL Communications Corp.,
6 Innovation Road II,
Science-Based Industrial Park,
Hsinchu, 300, Taiwan.

E-mail: techwriters@zyxel.com.tw

Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.



Warnings tell you about things that could harm you or your device.



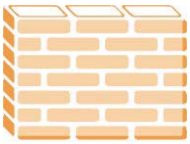
Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The ES-3124, ES-3124PWR, ES-3124-4F, and ES-3124F may be referred to as the "Switch", the "device", the "system" or the "product" in this User's Guide. Distinction is made where necessary.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The Switch icon is not an exact representation of your device.

Switch 	Computer 	Notebook computer 
Server 	DSLAM 	Firewall 
Telephone 	Switch 	Router 

Safety Warnings

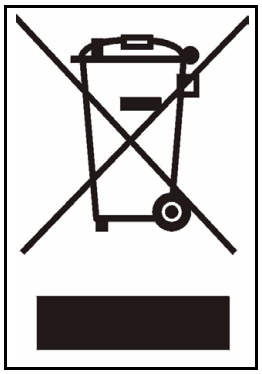


For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device. Connect it to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Use ONLY power wires of the appropriate wire gauge (see Section 38.1 on page 291 for details) for your device. Connect it to a power supply of the correct voltage (see Section 38.1 on page 291 for details).
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the device and the power source.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Caution: Risk of explosion if battery (on the motherboard) is replaced by an incorrect type. Dispose of used batteries according to the instructions. Dispose them at the applicable collection point for the recycling of electrical and electronic equipment. For detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the store where you purchased the product.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.
- The PoE (Power over Ethernet) devices that supply or receive power and their connected Ethernet cables must all be completely indoors.

- The length of exposed (bare) power wire should not exceed 7 mm.

This product is recyclable. Dispose of it properly.



Contents Overview

Introduction **31**

Introducing the Switch 33

Hardware **39**

Hardware Installation and Connection 41
Hardware Overview 45

Web Configurator **53**

The Web Configurator 55
Initial Setup Example 65
System Status and Port Statistics 69
Basic Setting 75
VLAN 87
Static MAC Forward Setup 105
Filtering 107
Spanning Tree Protocol 109
Bandwidth Control 127
Broadcast Storm Control 129
Mirroring 131
Link Aggregation 133
Port Authentication 141
Port Security 147
Classifier 151
Policy Rule 157
Queuing Method 163
VLAN Stacking 167
Multicast 173
Authentication & Accounting 187
IP Source Guard 201
Loop Guard 221
Static Routing 225
Differentiated Services 227
DHCP 235
Maintenance 241
Access Control 247
Diagnostic 267
Syslog 269

Cluster Management 273
MAC Table 279
ARP Table 281
Configure Clone 283

Troubleshooting and Specifications 285

Troubleshooting 287
Product Specifications 291

Appendices and Index 299

Table of Contents

About This User's Guide **3**

Document Conventions **4**

Safety Warnings **6**

Contents Overview **9**

Table of Contents **11**

List of Figures **21**

List of Tables **27**

Part I: Introduction **31**

Chapter 1
Introducing the Switch **33**

1.1 Overview 33
1.1.1 Backbone Application 33
1.1.2 Bridging Example 34
1.1.3 High-performance Switched Example 35
1.1.4 IEEE 802.1Q VLAN Application Examples 35
1.2 Ways to Manage the Switch 36
1.3 Good Habits for Managing the Switch 37

Part II: Hardware **39**

Chapter 2
Hardware Installation and Connection **41**

2.1 Freestanding Installation 41
2.2 Mounting the Switch on a Rack 42
2.2.1 Rack-mounted Installation Requirements 42
2.2.2 Attaching the Mounting Brackets to the Switch 42
2.2.3 Mounting the Switch on a Rack 43

Chapter 3
Hardware Overview **45**

3.1 Panel Connections 45
3.1.1 Console Port 47
3.1.2 Ethernet Ports 47
3.1.3 Transceiver Slots 48
3.2 Rear Panel 49
3.2.1 Power Connector 50
3.2.2 External Backup Power Supply Connector 50
3.3 LEDs 50

Part III: Web Configurator 53

Chapter 4
The Web Configurator 55

4.1 Introduction 55
4.2 System Login 55
4.3 The Status Screen 56
4.3.1 Change Your Password 61
4.4 Saving Your Configuration 61
4.5 Switch Lockout 62
4.6 Resetting the Switch 62
4.6.1 Reload the Configuration File 62
4.7 Logging Out of the Web Configurator 63
4.8 Help 64

Chapter 5
Initial Setup Example 65

5.1 Overview 65
5.1.1 Creating a VLAN 65
5.1.2 Setting Port VID 66
5.2 Configuring Switch Management IP Address 67

Chapter 6
System Status and Port Statistics 69

6.1 Overview 69
6.2 Port Status Summary 69
6.2.1 Status: Port Details 70

Chapter 7
Basic Setting 75

7.1 Overview 75
7.2 System Information 75

7.3 General Setup 77
7.4 Introduction to VLANs 79
7.5 Switch Setup Screen 80
7.6 IP Setup 82
7.6.1 IP Interfaces 82
7.7 Port Setup 84

Chapter 8
VLAN 87

8.1 Introduction to IEEE 802.1Q Tagged VLANs 87
8.1.1 Forwarding Tagged and Untagged Frames 87
8.2 Automatic VLAN Registration 88
8.2.1 GARP 88
8.2.2 GVRP 88
8.3 Port VLAN Trunking 89
8.4 Select the VLAN Type 89
8.5 Static VLAN 89
8.5.1 Static VLAN Status 90
8.5.2 Static VLAN Details 90
8.5.3 Configure a Static VLAN 91
8.5.4 Configure VLAN Port Settings 92
8.6 Subnet Based VLANs 94
8.7 Configuring Subnet Based VLAN 95
8.8 Protocol Based VLANs 96
8.9 Configuring Protocol Based VLAN 97
8.10 Create an IP-based VLAN Example 99
8.11 Port-based VLAN Setup 100
8.11.1 Configure a Port-based VLAN 100

Chapter 9
Static MAC Forward Setup 105

9.1 Overview 105
9.2 Configuring Static MAC Forwarding 105

Chapter 10
Filtering 107

10.1 Configure a Filtering Rule 107

Chapter 11
Spanning Tree Protocol 109

11.1 STP/RSTP Overview 109
11.1.1 STP Terminology 109
11.1.2 How STP Works 110

11.1.3 STP Port States 111
11.1.4 Multiple RSTP 111
11.1.5 Multiple STP 112
11.2 Spanning Tree Protocol Status Screen 114
11.3 Spanning Tree Configuration 115
11.4 Configure Rapid Spanning Tree Protocol 116
11.5 Rapid Spanning Tree Protocol Status 117
11.6 Configure Multiple Rapid Spanning Tree Protocol 119
11.7 Multiple Rapid Spanning Tree Protocol Status 120
11.8 Configure Multiple Spanning Tree Protocol 122
11.9 Multiple Spanning Tree Protocol Status 124

Chapter 12
Bandwidth Control 127

12.1 Bandwidth Control Overview 127
12.1.1 CIR and PIR 127
12.2 Bandwidth Control Setup 127

Chapter 13
Broadcast Storm Control 129

13.1 Broadcast Storm Control Setup 129

Chapter 14
Mirroring 131

14.1 Port Mirroring Setup 131

Chapter 15
Link Aggregation 133

15.1 Link Aggregation Overview 133
15.2 Dynamic Link Aggregation 133
15.2.1 Link Aggregation ID 134
15.3 Link Aggregation Status 134
15.4 Link Aggregation Setting 135
15.5 Link Aggregation Control Protocol 136
15.6 Static Trunking Example 138

Chapter 16
Port Authentication 141

16.1 Port Authentication Overview 141
16.1.1 IEEE 802.1x Authentication 141
16.1.2 MAC Authentication 142
16.2 Port Authentication Configuration 143
16.2.1 Activate IEEE 802.1x Security 143

16.2.2 Activate MAC Authentication 144

Chapter 17
Port Security 147

17.1 About Port Security 147
17.2 Port Security Setup 147

Chapter 18
Classifier 151

18.1 About the Classifier and QoS 151
18.2 Configuring the Classifier 151
18.3 Viewing and Editing Classifier Configuration 154
18.4 Classifier Example 155

Chapter 19
Policy Rule 157

19.1 Policy Rules Overview 157
19.1.1 DiffServ 157
19.1.2 DSCP and Per-Hop Behavior 157
19.2 Configuring Policy Rules 158
19.3 Viewing and Editing Policy Configuration 160
19.4 Policy Example 161

Chapter 20
Queuing Method 163

20.1 Queuing Method Overview 163
20.1.1 Strictly Priority 163
20.1.2 Weighted Fair Queuing 163
20.1.3 Weighted Round Robin Scheduling (WRR) 164
20.2 Configuring Queuing 164

Chapter 21
VLAN Stacking 167

21.1 VLAN Stacking Overview 167
21.1.1 VLAN Stacking Example 167
21.2 VLAN Stacking Port Roles 168
21.3 VLAN Tag Format 169
21.3.1 Frame Format 169
21.4 Configuring VLAN Stacking 170

Chapter 22
Multicast 173

22.1 Multicast Overview 173

22.1.1 IP Multicast Addresses 173
22.1.2 IGMP Filtering 173
22.1.3 IGMP Snooping 173
22.1.4 IGMP Snooping and VLANs 174
22.2 Multicast Status 174
22.3 Multicast Setting 174
22.4 IGMP Snooping VLAN 176
22.5 IGMP Filtering Profile 178
22.6 MVR Overview 179
22.6.1 Types of MVR Ports 179
22.6.2 MVR Modes 180
22.6.3 How MVR Works 180
22.7 General MVR Configuration 180
22.8 MVR Group Configuration 182
22.8.1 MVR Configuration Example 183

Chapter 23
Authentication & Accounting 187

23.1 Authentication, Authorization and Accounting 187
23.1.1 Local User Accounts 187
23.1.2 RADIUS and TACACS+ 188
23.2 Authentication and Accounting Screens 188
23.2.1 RADIUS Server Setup 188
23.2.2 TACACS+ Server Setup 190
23.2.3 Authentication and Accounting Setup 192
23.2.4 Vendor Specific Attribute 195
23.3 Supported RADIUS Attributes 196
23.3.1 Attributes Used for Authentication 197
23.3.2 Attributes Used for Accounting 197

Chapter 24
IP Source Guard 201

24.1 IP Source Guard Overview 201
24.1.1 DHCP Snooping Overview 201
24.1.2 ARP Inspection Overview 203
24.2 IP Source Guard 205
24.3 IP Source Guard Static Binding 205
24.4 DHCP Snooping 207
24.5 DHCP Snooping Configure 210
24.5.1 DHCP Snooping Port Configure 211
24.5.2 DHCP Snooping VLAN Configure 213
24.6 ARP Inspection Status 214
24.6.1 ARP Inspection VLAN Status 214

24.6.2 ARP Inspection Log Status 215
24.7 ARP Inspection Configure 217
24.7.1 ARP Inspection Port Configure 218
24.7.2 ARP Inspection VLAN Configure 219

Chapter 25
Loop Guard 221

25.1 Loop Guard Overview 221
25.2 Loop Guard Setup 223

Chapter 26
Static Routing 225

26.1 Configuring Static Routing 225

Chapter 27
Differentiated Services 227

27.1 DiffServ Overview 227
27.1.1 DSCP and Per-Hop Behavior 227
27.1.2 DiffServ Network Example 228
27.2 Two Rate Three Color Marker Traffic Policing 228
27.2.1 TRTCM - Color-blind Mode 229
27.2.2 TRTCM - Color-aware Mode 229
27.3 Activating DiffServ 230
27.3.1 Configuring 2-Rate 3 Color Marker Settings 230
27.4 DSCP-to-IEEE 802.1p Priority Settings 232
27.4.1 Configuring DSCP Settings 232

Chapter 28
DHCP 235

28.1 DHCP Overview 235
28.1.1 DHCP Modes 235
28.1.2 DHCP Configuration Options 235
28.2 DHCP Status 235
28.3 DHCP Relay 236
28.3.1 DHCP Relay Agent Information 236
28.3.2 Configuring DHCP Global Relay 237
28.3.3 Global DHCP Relay Configuration Example 238
28.4 Configuring DHCP VLAN Settings 238
28.4.1 Example: DHCP Relay for Two VLANs 240

Chapter 29
Maintenance 241

29.1 The Maintenance Screen 241

29.2 Load Factory Default 242
29.3 Save Configuration 242
29.4 Reboot System 243
29.5 Firmware Upgrade 243
29.6 Restore a Configuration File 244
29.7 Backup a Configuration File 244
29.8 FTP Command Line 245
29.8.1 Filename Conventions 245
29.8.2 FTP Command Line Procedure 245
29.8.3 GUI-based FTP Clients 246
29.8.4 FTP Restrictions 246

Chapter 30
Access Control 247

30.1 Access Control Overview 247
30.2 The Access Control Main Screen 247
30.3 About SNMP 248
30.3.1 SNMP v3 and Security 249
30.3.2 Supported MIBs 249
30.3.3 SNMP Traps 249
30.3.4 Configuring SNMP 255
30.3.5 Configuring SNMP Trap Group 257
30.3.6 Setting Up Login Accounts 258
30.4 SSH Overview 260
30.5 How SSH works 260
30.6 SSH Implementation on the Switch 261
30.6.1 Requirements for Using SSH 261
30.7 Introduction to HTTPS 261
30.8 HTTPS Example 262
30.8.1 Internet Explorer Warning Messages 262
30.8.2 Netscape Navigator Warning Messages 263
30.8.3 The Main Screen 263
30.9 Service Port Access Control 264
30.10 Remote Management 265

Chapter 31
Diagnostic 267

31.1 Diagnostic 267

Chapter 32
Syslog 269

32.1 Syslog Overview 269
32.2 Syslog Setup 269

32.3 Syslog Server Setup 270

Chapter 33
Cluster Management 273

33.1 Clustering Management Status Overview 273
33.2 Cluster Management Status 274
33.2.1 Cluster Member Switch Management 275
33.3 Clustering Management Configuration 276

Chapter 34
MAC Table 279

34.1 MAC Table Overview 279
34.2 Viewing the MAC Table 280

Chapter 35
ARP Table 281

35.1 ARP Table Overview 281
35.1.1 How ARP Works 281
35.2 Viewing the ARP Table 281

Chapter 36
Configure Clone 283

36.1 Configure Clone 283

Part IV: Troubleshooting and Specifications 285

Chapter 37
Troubleshooting 287

37.1 Power, Hardware Connections, and LEDs 287
37.2 Switch Access and Login 288

Chapter 38
Product Specifications 291

38.1 General Switch Specifications 291
38.2 Cable Pin Assignments 296

Part V: Appendices and Index 299

Appendix A Setting up Your Computer's IP Address 301

Appendix B Pop-up Windows, JavaScripts and Java Permissions 323

Appendix C IP Addresses and Subnetting 331
Appendix D Common Services 341
Appendix E Importing Certificates 345
Appendix F Legal Information 351
Appendix G Customer Support 355
Index 361

List of Figures

Figure 1 Backbone Application 34
Figure 2 Bridging Application 34
Figure 3 High-performance Switched Application 35
Figure 4 Tag-based VLAN Application 36
Figure 5 Shared Server Using VLAN Example 36
Figure 6 Attaching Rubber Feet 41
Figure 7 Attaching the Mounting Brackets 42
Figure 8 Mounting the Switch on a Rack 43
Figure 9 Front Panel: ES-3124 45
Figure 10 Front Panel: ES-3124-4F 45
Figure 11 Front Panel: ES-3124PWR 46
Figure 12 Front Panel: ES-3124F 46
Figure 13 Transceiver Installation Example 48
Figure 14 Installed Transceiver 49
Figure 15 Opening the Transceiver's Latch Example 49
Figure 16 Transceiver Removal Example 49
Figure 17 Rear Panel (AC models) 49
Figure 18 Rear Panel (DC models) 50
Figure 19 Web Configurator: Login 56
Figure 20 Web Configurator Home Screen (Status) 56
Figure 21 Change Administrator Login Password 61
Figure 22 Resetting the Switch: Via the Console Port 63
Figure 23 Web Configurator: Logout Screen 63
Figure 24 Initial Setup Network Example: VLAN 65
Figure 25 Initial Setup Network Example: Port VID 66
Figure 26 Initial Setup Example: Management IP Address 67
Figure 27 Status 69
Figure 28 Status: Port Details 71
Figure 29 Basic Setting > System Info 76
Figure 30 Basic Setting > General Setup 78
Figure 31 Basic Setting > Switch Setup 80
Figure 32 Basic Setting > IP Setup 82
Figure 33 Basic Setting > Port Setup 84
Figure 34 Port VLAN Trunking 89
Figure 35 Switch Setup: Select VLAN Type 89
Figure 36 Advanced Application > VLAN: VLAN Status 90
Figure 37 Advanced Application > VLAN > VLAN Detail 90
Figure 38 Advanced Application > VLAN > Static VLAN 91

Figure 39 Advanced Application > VLAN > VLAN Port Setting 93
Figure 40 Subnet Based VLAN Application Example 94
Figure 41 Advanced Application > VLAN > VLAN Port Setting > Subnet Based VLAN 95
Figure 42 Protocol Based VLAN Application Example 97
Figure 43 Advanced Application > VLAN > VLAN Port Setting > Protocol Based VLAN 98
Figure 44 Protocol Based VLAN Configuration Example 99
Figure 45 Advanced Application > VLAN: Port Based VLAN Setup (All Connected) 101
Figure 46 Advanced Application > VLAN: Port Based VLAN Setup (Port Isolation) 102
Figure 47 Advanced Application > Static MAC Forwarding 105
Figure 48 Advanced Application > Filtering 107
Figure 49 MRSTP Network Example 111
Figure 50 STP/RSTP Network Example 112
Figure 51 MSTP Network Example 113
Figure 52 MSTIs in Different Regions 114
Figure 53 MSTP and Legacy RSTP Network Example 114
Figure 54 Advanced Application > Spanning Tree Protocol 115
Figure 55 Advanced Application > Spanning Tree Protocol > Configuration 115
Figure 56 Advanced Application > Spanning Tree Protocol > RSTP 116
Figure 57 Advanced Application > Spanning Tree Protocol > Status: RSTP 118
Figure 58 Advanced Application > Spanning Tree Protocol > MRSTP 119
Figure 59 Advanced Application > Spanning Tree Protocol > Status: MRSTP 121
Figure 60 Advanced Application > Spanning Tree Protocol > MSTP 122
Figure 61 Advanced Application > Spanning Tree Protocol > Status: MSTP 125
Figure 62 Advanced Application > Bandwidth Control 128
Figure 63 Advanced Application > Broadcast Storm Control 129
Figure 64 Advanced Application > Mirroring 131
Figure 65 Advanced Application > Link Aggregation Status 134
Figure 66 Advanced Application > Link Aggregation > Link Aggregation Setting 135
Figure 67 Advanced Application > Link Aggregation > Link Aggregation Setting > LACP 137
Figure 68 Trunking Example - Physical Connections 138
Figure 69 Trunking Example - Configuration Screen 139
Figure 70 IEEE 802.1x Authentication Process 142
Figure 71 MAC Authentication Process 142
Figure 72 Advanced Application > Port Authentication 143
Figure 73 Advanced Application > Port Authentication > 802.1x 143
Figure 74 Advanced Application > Port Authentication > MAC Authentication 145
Figure 75 Advanced Application > Port Security 148
Figure 76 Advanced Application > Classifier 152
Figure 77 Advanced Application > Classifier: Summary Table 154
Figure 78 Classifier: Example 156
Figure 79 Advanced Application > Policy Rule 158
Figure 80 Advanced Application > Policy Rule: Summary Table 160
Figure 81 Policy Example 161

Figure 82 Advanced Application > Queuing Method 164
Figure 83 VLAN Stacking Example 168
Figure 84 Advanced Application > VLAN Stacking 170
Figure 85 Advanced Application > Multicast 174
Figure 86 Advanced Application > Multicast > Multicast Setting 175
Figure 87 Advanced Application > Multicast > Multicast Setting > IGMP Snooping VLAN 177
Figure 88 Advanced Application > Multicast > Multicast Setting > IGMP Filtering Profile 178
Figure 89 MVR Network Example 179
Figure 90 MVR Multicast Television Example 180
Figure 91 Advanced Application > Multicast > Multicast Setting > MVR 181
Figure 92 Advanced Application > Multicast > Multicast Setting > MVR: Group Configuration 183
Figure 93 MVR Configuration Example 184
Figure 94 MVR Configuration Example 184
Figure 95 MVR Group Configuration Example 185
Figure 96 MVR Group Configuration Example 185
Figure 97 AAA Server 187
Figure 98 Advanced Application > Auth and Acct 188
Figure 99 Advanced Application > Auth and Acct > RADIUS Server Setup 189
Figure 100 Advanced Application > Auth and Acct > TACACS+ Server Setup 191
Figure 101 Advanced Application > Auth and Acct > Auth and Acct Setup 193
Figure 102 DHCP Snooping Database File Format 202
Figure 103 Example: Man-in-the-middle Attack 203
Figure 104 Advanced Application > IP Source Guard 205
Figure 105 Advanced Application > IP Source Guard > Static Binding 206
Figure 106 Advanced Application > IP Source Guard > DHCP Snooping 207
Figure 107 Advanced Application > IP Source Guard > DHCP Snooping > Configure 210
Figure 108 Advanced Application > IP Source Guard > DHCP Snooping > Configure > Port 212
Figure 109 Advanced Application > IP Source Guard > DHCP Snooping > Configure > VLAN 213
Figure 110 Advanced Application > IP Source Guard > ARP Inspection 214
Figure 111 ARP Inspection VLAN Status 215
Figure 112 Advanced Application > IP Source Guard > ARP Inspection > Log Status 216
Figure 113 Advanced Application > IP Source Guard > ARP Inspection > Configure 217
Figure 114 Advanced Application > IP Source Guard > ARP Inspection > Configure > Port 218
Figure 115 Advanced Application > IP Source Guard > ARP Inspection > Configure > VLAN 219
Figure 116 Loop Guard vs STP 221
Figure 117 Switch in Loop State 222
Figure 118 Loop Guard - Probe Packet 222
Figure 119 Loop Guard - Network Loop 222
Figure 120 Advanced Application > Loop Guard 223
Figure 121 IP Application > Static Routing 225
Figure 122 DiffServ: Differentiated Service Field 227
Figure 123 DiffServ Network 228
Figure 124 TRTCM - Color-blind Mode 229

Figure 125 TRTCM - Color-aware Mode 229
Figure 126 IP Application > DiffServ 230
Figure 127 IP Application > DiffServ > 2-rate 3 Color Marker 231
Figure 128 IP Application > DiffServ > DSCP Setting 232
Figure 129 IP Application > DHCP Status 236
Figure 130 IP Application > DHCP > Global 237
Figure 131 Global DHCP Relay Network Example 238
Figure 132 DHCP Relay Configuration Example 238
Figure 133 IP Application > DHCP > VLAN 239
Figure 134 DHCP Relay for Two VLANs 240
Figure 135 DHCP Relay for Two VLANs Configuration Example 240
Figure 136 Management > Maintenance 241
Figure 137 Load Factory Default: Start 242
Figure 138 Reboot System: Confirmation 243
Figure 139 Management > Maintenance > Firmware Upgrade 243
Figure 140 Management > Maintenance > Restore Configuration 244
Figure 141 Management > Maintenance > Backup Configuration 244
Figure 142 Management > Access Control 247
Figure 143 SNMP Management Model 248
Figure 144 Management > Access Control > SNMP 255
Figure 145 Management > Access Control > SNMP > Trap Group 257
Figure 146 Management > Access Control > Logins 259
Figure 147 SSH Communication Example 260
Figure 148 How SSH Works 260
Figure 149 HTTPS Implementation 262
Figure 150 Security Alert Dialog Box (Internet Explorer) 262
Figure 151 Security Certificate 1 (Netscape) 263
Figure 152 Security Certificate 2 (Netscape) 263
Figure 153 Example: Lock Denoting a Secure Connection 264
Figure 154 Management > Access Control > Service Access Control 264
Figure 155 Management > Access Control > Remote Management 265
Figure 156 Management > Diagnostic 267
Figure 157 Management > Syslog 270
Figure 158 Management > Syslog > Server Setup 271
Figure 159 Clustering Application Example 274
Figure 160 Management > Cluster Management 274
Figure 161 Cluster Management: Cluster Member Web Configurator Screen 275
Figure 162 Example: Uploading Firmware to a Cluster Member Switch 276
Figure 163 Management > Clustering Management > Configuration 277
Figure 164 MAC Table Flowchart 279
Figure 165 Management > MAC Table 280
Figure 166 Management > ARP Table 282
Figure 167 Management > Configure Clone 283

Figure 168 Console/Dial Backup Port Pin Layout 296
Figure 169 WIndows 95/98/Me: Network: Configuration 302
Figure 170 Windows 95/98/Me: TCP/IP Properties: IP Address 303
Figure 171 Windows 95/98/Me: TCP/IP Properties: DNS Configuration 304
Figure 172 Windows XP: Start Menu 305
Figure 173 Windows XP: Control Panel 305
Figure 174 Windows XP: Control Panel: Network Connections: Properties 306
Figure 175 Windows XP: Local Area Connection Properties 306
Figure 176 Windows XP: Internet Protocol (TCP/IP) Properties 307
Figure 177 Windows XP: Advanced TCP/IP Properties 308
Figure 178 Windows XP: Internet Protocol (TCP/IP) Properties 309
Figure 179 Windows Vista: Start Menu 310
Figure 180 Windows Vista: Control Panel 310
Figure 181 Windows Vista: Network And Internet 310
Figure 182 Windows Vista: Network and Sharing Center 310
Figure 183 Windows Vista: Network and Sharing Center 311
Figure 184 Windows Vista: Local Area Connection Properties 311
Figure 185 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties 312
Figure 186 Windows Vista: Advanced TCP/IP Properties 313
Figure 187 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties 314
Figure 188 Macintosh OS 8/9: Apple Menu 315
Figure 189 Macintosh OS 8/9: TCP/IP 315
Figure 190 Macintosh OS X: Apple Menu 316
Figure 191 Macintosh OS X: Network 317
Figure 192 Red Hat 9.0: KDE: Network Configuration: Devices 318
Figure 193 Red Hat 9.0: KDE: Ethernet Device: General 318
Figure 194 Red Hat 9.0: KDE: Network Configuration: DNS 319
Figure 195 Red Hat 9.0: KDE: Network Configuration: Activate 319
Figure 196 Red Hat 9.0: Dynamic IP Address Setting in ifconfig-eth0 320
Figure 197 Red Hat 9.0: Static IP Address Setting in ifconfig-eth0 320
Figure 198 Red Hat 9.0: DNS Settings in resolv.conf 320
Figure 199 Red Hat 9.0: Restart Ethernet Card 320
Figure 200 Red Hat 9.0: Checking TCP/IP Properties 321
Figure 201 Pop-up Blocker 323
Figure 202 Internet Options: Privacy 324
Figure 203 Internet Options: Privacy 325
Figure 204 Pop-up Blocker Settings 325
Figure 205 Internet Options: Security 326
Figure 206 Security Settings - Java Scripting 327
Figure 207 Security Settings - Java 327
Figure 208 Java (Sun) 328
Figure 209 Mozilla Firefox: Tools > Options 329
Figure 210 Mozilla Firefox Content Security 329

Figure 211 Network Number and Host ID 332
Figure 212 Subnetting Example: Before Subnetting 334
Figure 213 Subnetting Example: After Subnetting 335
Figure 214 Conflicting Computer IP Addresses Example 339
Figure 215 Conflicting Computer IP Addresses Example 339
Figure 216 Conflicting Computer and Router IP Addresses Example 340
Figure 217 Security Certificate 345
Figure 218 Login Screen 346
Figure 219 Certificate General Information before Import 346
Figure 220 Certificate Import Wizard 1 347
Figure 221 Certificate Import Wizard 2 347
Figure 222 Certificate Import Wizard 3 348
Figure 223 Root Certificate Store 348
Figure 224 Certificate General Information after Import 349

List of Tables

Table 1 Model-specific Features 33
Table 2 Panel Connections 46
Table 3 LEDs 50
Table 4 Navigation Panel Sub-links Overview 57
Table 5 Web Configurator Screen Sub-links Details 58
Table 6 Navigation Panel Links 59
Table 7 Status 69
Table 8 Status > Port Details 71
Table 9 Basic Setting > System Info 76
Table 10 Basic Setting > General Setup 78
Table 11 Basic Setting > Switch Setup 80
Table 12 Basic Setting > IP Setup 83
Table 13 Basic Setting > Port Setup 85
Table 14 IEEE 802.1Q VLAN Terminology 88
Table 15 Advanced Application > VLAN: VLAN Status 90
Table 16 Advanced Application > VLAN > VLAN Detail 91
Table 17 Advanced Application > VLAN > Static VLAN 92
Table 18 Advanced Application > VLAN > VLAN Port Setting 93
Table 19 Advanced Application > VLAN > VLAN Port Setting > Subnet Based VLAN Setup 95
Table 20 Advanced Application > VLAN > VLAN Port Setting > Protocol Based VLAN Setup 98
Table 21 Advanced Application > VLAN: Port Based VLAN Setup 103
Table 22 Advanced Application > Static MAC Forwarding 106
Table 23 Advanced Application > FIltering 107
Table 24 STP Path Costs 110
Table 25 STP Port States 111
Table 26 Advanced Application > Spanning Tree Protocol > Configuration 115
Table 27 Advanced Application > Spanning Tree Protocol > RSTP 116
Table 28 Advanced Application > Spanning Tree Protocol > Status: RSTP 118
Table 29 Advanced Application > Spanning Tree Protocol > MRSTP 119
Table 30 Advanced Application > Spanning Tree Protocol > Status: MRSTP 121
Table 31 Advanced Application > Spanning Tree Protocol > MSTP 123
Table 32 Advanced Application > Spanning Tree Protocol > Status: MSTP 125
Table 33 Advanced Application > Bandwidth Control 128
Table 34 Advanced Application > Broadcast Storm Control 130
Table 35 Advanced Application > Mirroring 132
Table 36 Link Aggregation ID: Local Switch 134
Table 37 Link Aggregation ID: Peer Switch 134
Table 38 Advanced Application > Link Aggregation Status 134

Table 39 Advanced Application > Link Aggregation > Link Aggregation Setting 136
Table 40 Advanced Application > Link Aggregation > Link Aggregation Setting > LACP 137
Table 41 Advanced Application > Port Authentication > 802.1x 144
Table 42 Advanced Application > Port Authentication > MAC Authentication 145
Table 43 Advanced Application > Port Security 148
Table 44 Advanced Application > Classifier 152
Table 45 Classifier: Summary Table 154
Table 46 Common Ethernet Types and Protocol Number 154
Table 47 Common IP Protocol Types and Protocol Numbers 155
Table 48 Common TCP and UDP Port Numbers 155
Table 49 Advanced Application > Policy Rule 159
Table 50 Policy: Summary Table 160
Table 51 Advanced Application > Queuing Method 165
Table 52 VLAN Tag Format 169
Table 53 Single and Double Tagged 802.11Q Frame Format 169
Table 54 802.1Q Frame 169
Table 55 Advanced Application > VLAN Stacking 170
Table 56 Multicast Status 174
Table 57 Advanced Application > Multicast > Multicast Setting 175
Table 58 Advanced Application > Multicast > Multicast Setting > IGMP Snooping VLAN 177
Table 59 Advanced Application > Multicast > Multicast Setting > IGMP Filtering Profile 178
Table 60 Advanced Application > Multicast > Multicast Setting > MVR 181
Table 61 Advanced Application > Multicast > Multicast Setting > MVR: Group Configuration 183
Table 62 RADIUS vs TACACS+ 188
Table 63 Advanced Application > Auth and Acct > RADIUS Server Setup 189
Table 64 Advanced Application > Auth and Acct > TACACS+ Server Setup 191
Table 65 Advanced Application > Auth and Acct > Auth and Acct Setup 193
Table 66 Supported VSAs 195
Table 67 Supported Tunnel Protocol Attribute 196
Table 68 RADIUS Attributes - Exec Events via Console 198
Table 69 RADIUS Attributes - Exec Events via Telnet/SSH 198
Table 70 RADIUS Attributes - Exec Events via Console 198
Table 71 Advanced Application > IP Source Guard 205
Table 72 Advanced Application > IP Source Guard > Static Binding 206
Table 73 Advanced Application > IP Source Guard > DHCP Snooping 208
Table 74 Advanced Application > IP Source Guard > DHCP Snooping > Configure 210
Table 75 Advanced Application > IP Source Guard > DHCP Snooping > Configure > Port 212
Table 76 Advanced Application > IP Source Guard > DHCP Snooping > Configure > VLAN 213
Table 77 Advanced Application > IP Source Guard > ARP Inspection 214
Table 78 ARP Inspection VLAN Status 215
Table 79 Advanced Application > IP Source Guard > ARP Inspection > Log Status 216
Table 80 Advanced Application > IP Source Guard > ARP Inspection > Configure 217
Table 81 Advanced Application > IP Source Guard > ARP Inspection > Configure > Port 219

Table 82 Advanced Application > IP Source Guard > ARP Inspection > Configure > VLAN 220
Table 83 Advanced Application > Loop Guard 223
Table 84 IP Application > Static Routing 225
Table 85 IP Application > DiffServ 230
Table 86 IP Application > DiffServ > 2-rate 3 Color Marker 231
Table 87 Default DSCP-IEEE 802.1p Mapping 232
Table 88 IP Application > DiffServ > DSCP Setting 233
Table 89 IP Application > DHCP Status 236
Table 90 Relay Agent Information 237
Table 91 IP Application > DHCP > Global 237
Table 92 IP Application > DHCP > VLAN 239
Table 93 Management > Maintenance 241
Table 94 Filename Conventions 245
Table 95 General Commands for GUI-based FTP Clients 246
Table 96 Access Control Overview 247
Table 97 SNMP Commands 248
Table 98 Object ID by Model 249
Table 99 SNMP System Traps 249
Table 100 SNMP Interface Traps 252
Table 101 AAA Traps 253
Table 102 SNMP IP Traps 254
Table 103 SNMP Switch Traps 254
Table 104 Management > Access Control > SNMP 256
Table 105 Management > Access Control > SNMP > Trap Group 258
Table 106 Management > Access Control > Logins 259
Table 107 Management > Access Control > Service Access Control 265
Table 108 Management > Access Control > Remote Management 265
Table 109 Management > Diagnostic 267
Table 110 Syslog Severity Levels 269
Table 111 Management > Syslog 270
Table 112 Management > Syslog > Server Setup 271
Table 113 ZyXEL Clustering Management Specifications 273
Table 114 Management > Cluster Management 275
Table 115 FTP Upload to Cluster Member Example 276
Table 116 Management > Clustering Management > Configuration 277
Table 117 Management > MAC Table 280
Table 118 Management > ARP Table 282
Table 119 Management > Configure Clone 284
Table 120 Hardware and Environmental Specifications 291
Table 121 Feature Specifications 293
Table 122 Standards Supported 294
Table 123 Console/Dial Backup Port Pin Assignments 296
Table 124 Ethernet Cable Pin Assignments 296

Table 125 IP Address Network Number and Host ID Example 332
Table 126 Subnet Masks 333
Table 127 Maximum Host Numbers 333
Table 128 Alternative Subnet Mask Notation 333
Table 129 Subnet 1 335
Table 130 Subnet 2 336
Table 131 Subnet 3 336
Table 132 Subnet 4 336
Table 133 Eight Subnets 336
Table 134 24-bit Network Number Subnet Planning 337
Table 135 16-bit Network Number Subnet Planning 337
Table 136 Commonly Used Services 341

PART I
Introduction

Introducing the Switch (33)

1

Introducing the Switch

This User's Guide covers the following models: ES-3124, ES-3124-4F, ES-3124-PWR and ES-3124F. The following table lists features that are specific to individual models.

Table 1 Model-specific Features

MODEL FEATURE	ES-3124	ES-3124-4F	ES-3124PWR	ES-3124F
Dual Personality Port	X	X	X	X
2 RJ-45 Gigabit ports for stacking	X		X	
2 Mini-GBIC ports for stacking		X		X
24 Fast Ethernet SFP Slots				X
IEEE 802.3af Power over Ethernet compliant Ethernet Ports			X	

See Chapter 38 on page 291 for a complete list of features that are common to all of the models.

This chapter introduces the main applications and features of the Switch. It also introduces the ways you can manage the Switch.

1.1 Overview

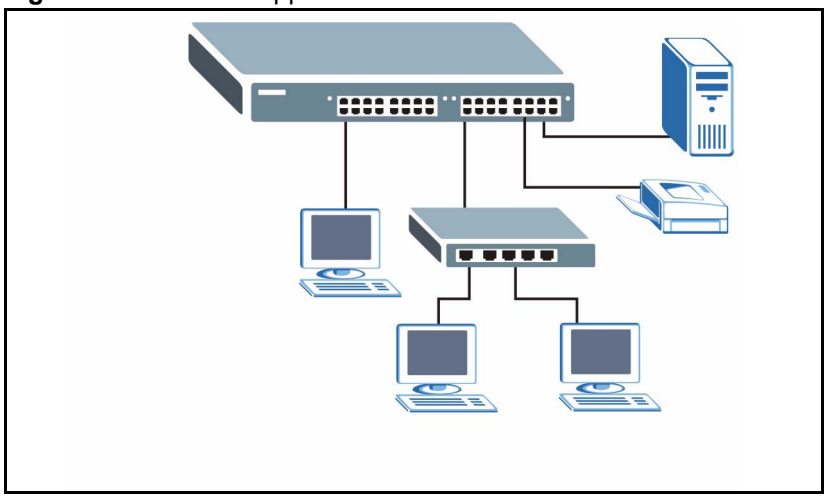
This section shows a few examples of using the Switch in various network environments.

1.1.1 Backbone Application

The Switch is an ideal solution for small networks where rapid growth can be expected in the near future. The Switch can be used standalone for a group of heavy-traffic users. You can connect computers directly to the Switch's port or connect other switches to the Switch.

In this example, all computers share high-speed applications on the server. To expand the network, simply add more networking devices such as switches, routers, computers, print servers, etc.

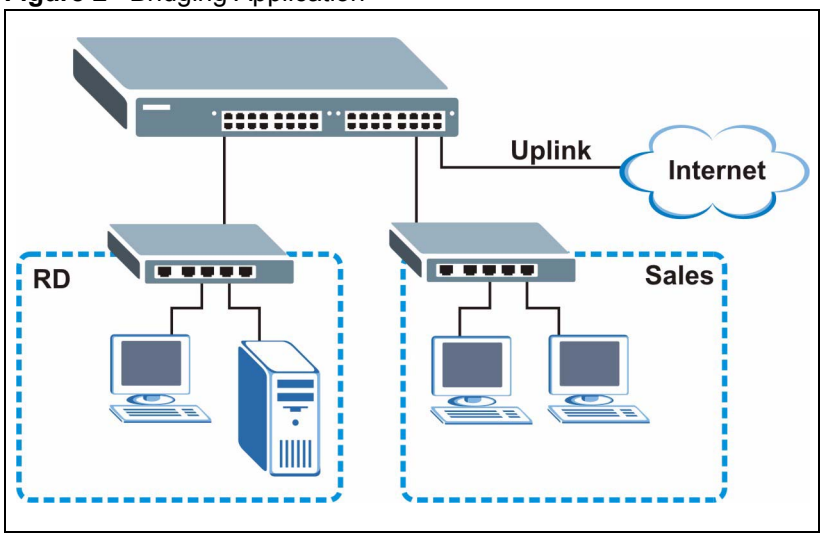
Figure 1 Backbone Application



1.1.2 Bridging Example

The Switch can connect different company departments (**RD** and **Sales**) to the corporate backbone. It can alleviate bandwidth contention and eliminate server and network bottlenecks. All users that need high bandwidth can connect to high-speed department servers via the Switch. You can provide a super-fast uplink connection by using a Gigabit Ethernet/mini-GBIC port on the Switch. Moreover, the Switch eases supervision and maintenance by allowing network managers to centralize multiple servers at a single location.

Figure 2 Bridging Application

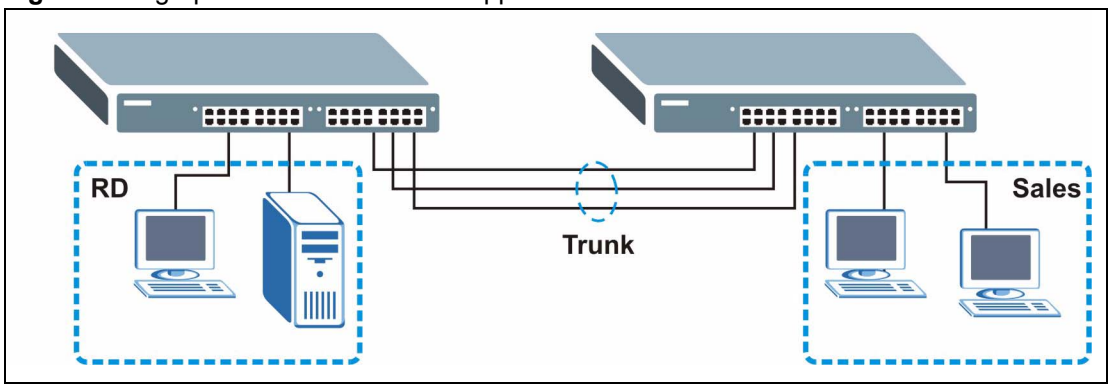


1.1.3 High-performance Switched Example

The Switch is ideal for connecting two networks that need high bandwidth. Switching to higher-speed LANs such as ATM (Asynchronous Transmission Mode) is not feasible for most people due to the expense of replacing all existing Ethernet cables and adapter cards, restructuring your network, and complex maintenance. The Switch can provide the same bandwidth as ATM at much lower cost while still being able to use existing adapters and switches. Moreover, the current LAN structure can be retained as all ports can freely communicate with each other.

In the following example, two Switches use trunking to connect two networks.

Figure 3 High-performance Switched Application



1.1.4 IEEE 802.1Q VLAN Application Examples

This section shows a workgroup and a shared server example using 802.1Q tagged VLANs.

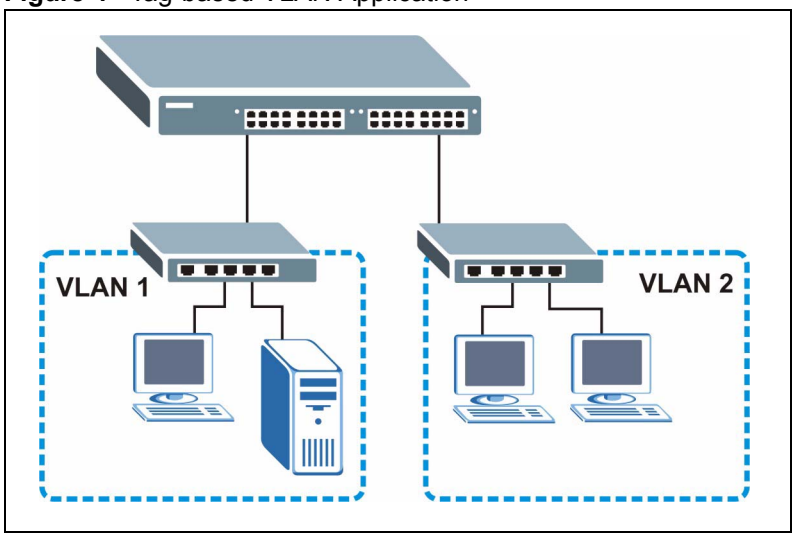
A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Stations on a logical network belong to one group. A station can belong to more than one group. With VLAN, a station cannot directly talk to or hear from stations that are not in the same group(s) unless such traffic first goes through a router.

For more information on VLANs, refer to Chapter 8 on page 87.

1.1.4.1 Tag-based VLAN Example

Ports in the same VLAN group share the same frame-broadcast domain and thus increase network performance through reduced broadcast traffic. VLAN groups can be modified at any time by adding, moving or changing ports without any re-cabling.

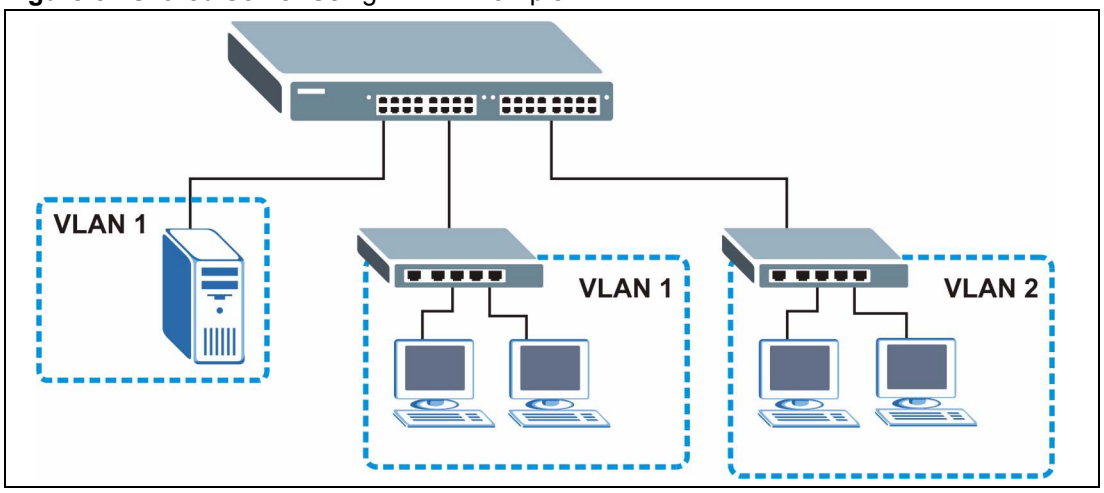
Figure 4 Tag-based VLAN Application



1.1.4.2 VLAN Shared Server Example

Shared resources such as a server can be used by all ports in the same VLAN as the server, as shown in the following example. In this example, only ports that need access to the server need belong to VLAN 1. Ports can belong to other VLAN groups too.

Figure 5 Shared Server Using VLAN Example



1.2 Ways to Manage the Switch

Use any of the following methods to manage the Switch.

- Web Configurator. This is recommended for everyday management of the Switch using a (supported) web browser. See Chapter 4 on page 55.
- Command Line Interface. Line commands offer an alternative to the Web Configurator and may be necessary to configure advanced features. See the CLI Reference Guide.
- FTP. Use File Transfer Protocol for firmware upgrades and configuration backup/restore. See Section 29.8 on page 245.

- SNMP. The device can be monitored and/or managed by an SNMP manager. See Section 30.3 on page 248.

1.3 Good Habits for Managing the Switch

Do the following things regularly to make the Switch more secure and to manage the Switch more effectively.

- Change the password. Use a password that's not easy to guess and that consists of different types of characters, such as numbers and letters.
- Write down the password and put it in a safe place.
- Back up the configuration (and make sure you know how to restore it). Restoring an earlier working configuration may be useful if the device becomes unstable or even crashes. If you forget your password, you will have to reset the Switch to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the Switch. You could simply restore your last configuration.

PART II
Hardware

Hardware Installation and Connection (41)
Hardware Overview (45)

2

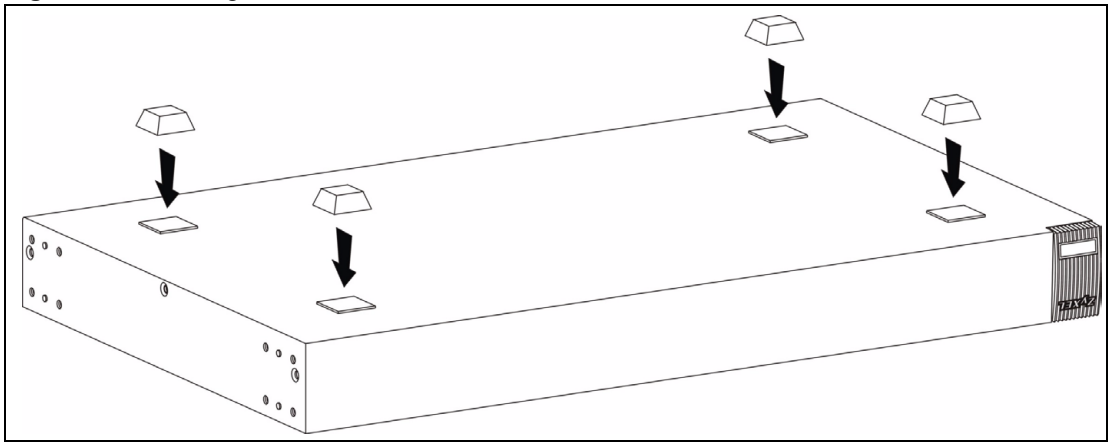
Hardware Installation and Connection

This chapter shows you how to install and connect the Switch.

2.1 Freestanding Installation

1. Make sure the Switch is clean and dry.
2. Set the Switch on a smooth, level surface strong enough to support the weight of the Switch and the connected cables. Make sure there is a power outlet nearby.
3. Make sure there is enough clearance around the Switch to allow air circulation and the attachment of cables and the power cord.
4. Remove the adhesive backing from the rubber feet.
5. Attach the rubber feet to each corner on the bottom of the Switch. These rubber feet help protect the Switch from shock or vibration and ensure space between devices when stacking.

Figure 6 Attaching Rubber Feet



Do NOT block the ventilation holes. Leave space between devices when stacking. For proper ventilation, allow at least 4 inches (10 cm) of clearance at the front and 3.4 inches (8 cm) at the back of the Switch. This is especially important for enclosed rack installations.

2.2 Mounting the Switch on a Rack

This section lists the rack mounting requirements and precautions and describes the installation steps.

2.2.1 Rack-mounted Installation Requirements

- Two mounting brackets.
- Eight M3 flat head screws and a #2 Phillips screwdriver.
- Four M5 flat head screws and a #2 Phillips screwdriver.

Failure to use the proper screws may damage the unit.

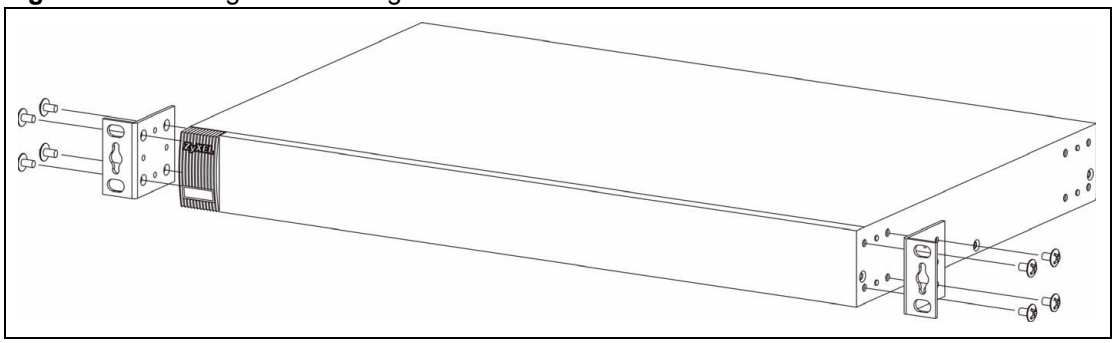
2.2.1.1 Precautions

- Make sure the rack will safely support the combined weight of all the equipment it contains.
- Make sure the position of the Switch does not make the rack unstable or top-heavy. Take all necessary precautions to anchor the rack securely before installing the unit.

2.2.2 Attaching the Mounting Brackets to the Switch

1 Position a mounting bracket on one side of the Switch, lining up the four screw holes on the bracket with the screw holes on the side of the Switch.

Figure 7 Attaching the Mounting Brackets



2 Using a #2 Phillips screwdriver, install the M3 flat head screws through the mounting bracket holes into the Switch.

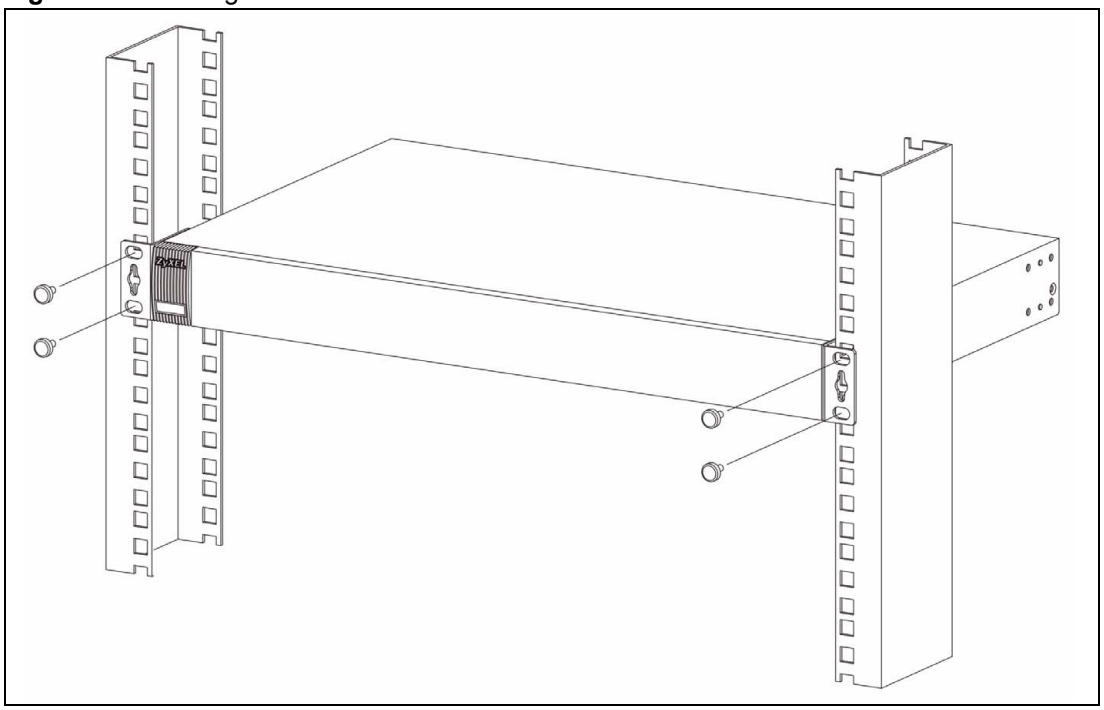
3 Repeat steps 1 and 2 to install the second mounting bracket on the other side of the Switch.

4 You may now mount the Switch on a rack. Proceed to the next section.

2.2.3 Mounting the Switch on a Rack

1 Position a mounting bracket (that is already attached to the Switch) on one side of the rack, lining up the two screw holes on the bracket with the screw holes on the side of the rack.

Figure 8 Mounting the Switch on a Rack



2 Using a #2 Phillips screwdriver, install the M5 flat head screws through the mounting bracket holes into the rack.

3 Repeat steps 1 and 2 to attach the second mounting bracket on the other side of the rack.

3

Hardware Overview

This chapter describes the front panel and rear panel of the Switch and shows you how to make the hardware connections.

3.1 Panel Connections

The figure below shows the front panel of the Switch.

Figure 9 Front Panel: ES-3124

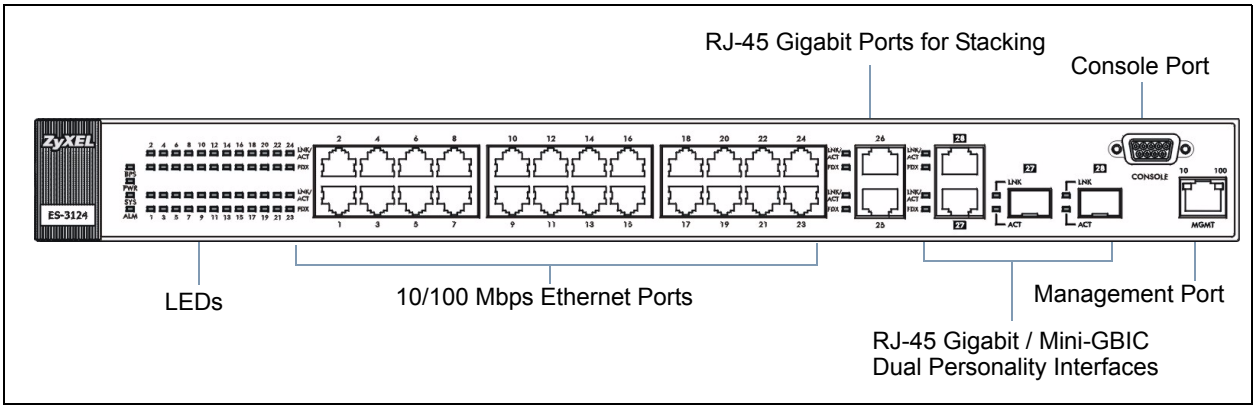


Figure 10 Front Panel: ES-3124-4F

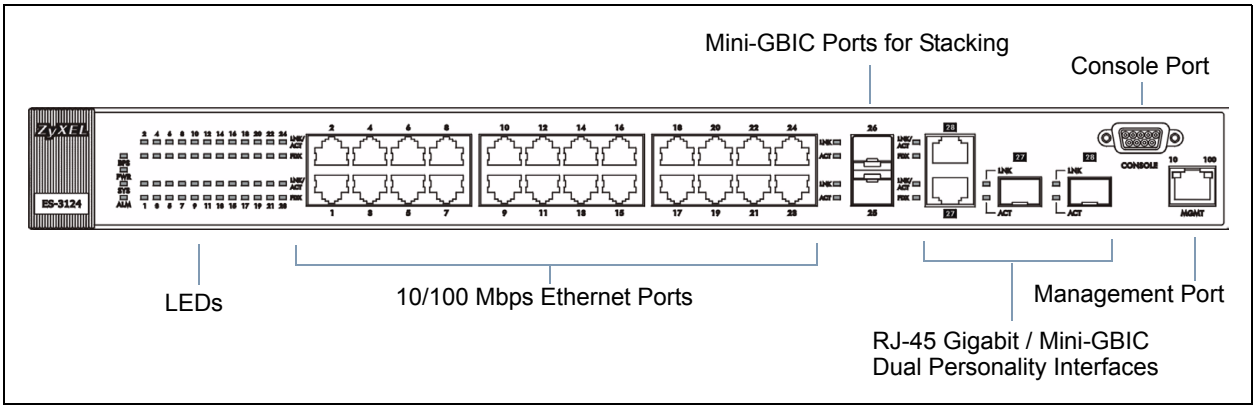


Figure 11 Front Panel: ES-3124PWR

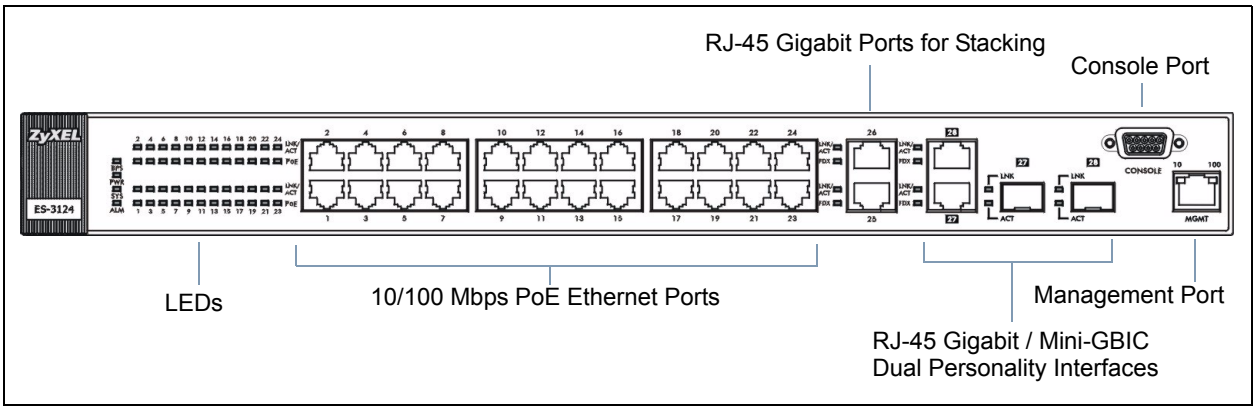
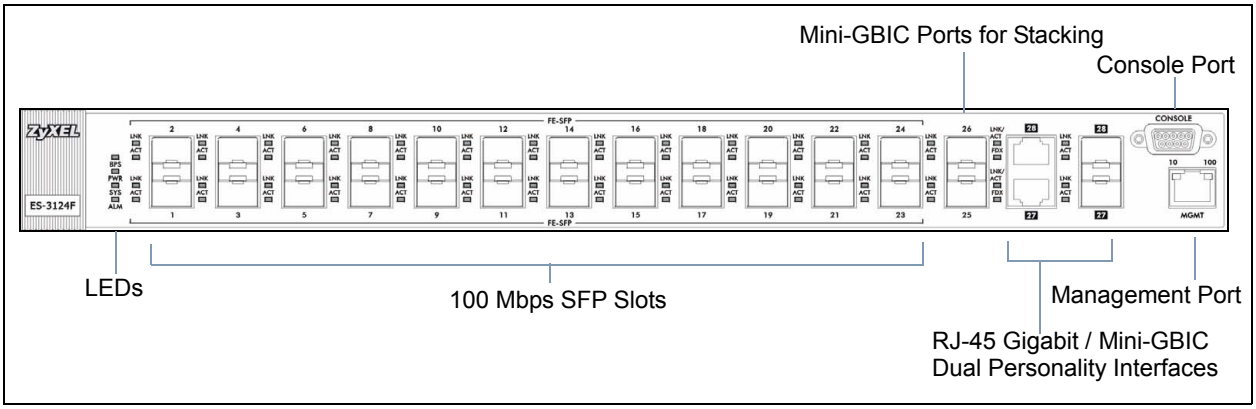


Figure 12 Front Panel: ES-3124F



The following table describes the ports on the panels.

Table 2 Panel Connections

CONNECTOR	DESCRIPTION
All Models	
Console Port	Only connect this port if you want to configure the Switch using the command line interface (CLI) via the console port.
Management Port	Connect to a computer using an RJ-45 Ethernet cable for local configuration of the Switch.
Dual Personality Interfaces	Each interface has one 1000 Base-T copper RJ-45 port and one Small Form-Factor Pluggable (SFP) slot (also called a mini-GBIC slot), with one port or transceiver active at a time.
2 100/1000 Mbps RJ-45 Ports	Connect these ports to high-bandwidth backbone network Ethernet switches using 1000Base-T compatible Category 5/5e/6 copper cables.
2 Mini-GBIC Slots	Use mini-GBIC transceivers in these slots for fiber-optic connections to backbone Ethernet switches.
ES-3124, ES-3124-4F and ES-3124PWR	
24 10/100 Mbps RJ-45 Ethernet Ports	Connect these ports to a computer, a hub, an Ethernet switch or router.
ES-3124F	

Table 2 Panel Connections (continued)

CONNECTOR	DESCRIPTION
24 100 Mbps Fast Ethernet SFP Slots	Connect these ports to a computer or switch.
ES-3124 and ES-3124PWR	
2 100/1000 Mbps RJ-45 Ports	Connect these ports to high-bandwidth backbone network Ethernet switches or use them to daisy-chain other switches. Use 1000Base-T compatible Category 5/5e/6 copper cables.
ES-3124-4F and ES-3124F	
2 Mini-GBIC Ports	Use mini-GBIC transceivers in these slots for fiber-optic connections to backbone network Ethernet switches or use them to daisy-chain other switches.
ES-3124PWR	
Power over Ethernet (PoE)	The 24 10/100 Mbps RJ-45 Ethernet ports are compliant with the IEEE 802.3af power over Ethernet standard.

3.1.1 Console Port

For local management, you can use a computer with terminal emulation software configured to the following parameters:

- VT100 terminal emulation
- 9600 bps
- No parity, 8 data bits, 1 stop bit
- No flow control

Connect the male 9-pin end of the console cable to the console port of the Switch. Connect the female end to a serial port (COM1, COM2 or other COM port) of your computer.

3.1.2 Ethernet Ports

The Switch has 24 10/100Mbps auto-negotiating, auto-crossover Ethernet ports. In 10/100Mbps Fast Ethernet, the speed can be 10Mbps or 100Mbps and the duplex mode can be half duplex or full duplex.

The Switch also comes with two pairs of Gigabit Ethernet/mini-GBIC ports. The mini-GBIC ports have priority over the Gigabit ports. This means that if a mini-GBIC port and the corresponding Gigabit port are connected at the same time, the Gigabit port will be disabled. The speed of the Gigabit Ethernet ports can be 100Mbps or 1000Mbps and the duplex mode can be half duplex (at 100 Mbps) or full duplex.

An auto-negotiating port can detect and adjust to the optimum Ethernet speed and duplex mode (full duplex or half duplex) of the connected device.

An auto-crossover (auto-MDI/MDI-X) port automatically works with a straight-through or crossover Ethernet cable.

3.1.2.1 Default Ethernet Settings

The factory default negotiation settings for the Ethernet ports on the Switch are:

- Speed: Auto
- Duplex: Auto

- Flow control: Off

3.1.3 Transceiver Slots

These are slots for mini-GBIC (Gigabit Interface Converter) transceivers or 100Mbps SFP (Small Form-Factor Pluggable) transceivers. A transceiver is a single unit that houses a transmitter and a receiver. The Switch does not come with transceivers. You must use transceivers that comply with the SFP Transceiver MultiSource Agreement (MSA). See the SFF committee's INF-8074i specification Rev 1.0 for details.

There are two pairs of Gigabit Ethernet/mini-GBIC ports. The mini-GBIC ports have priority over the Gigabit ports. This means that if a mini-GBIC port and the corresponding Gigabit port are connected at the same time, the Gigabit port will be disabled.

The ES-3124-4F and ES-3124F also have two mini-GBIC ports for connection to other switches.

The ES-3124F has 24 100Mbps SFP ports to connect to a computer or a switch.

You can change transceivers while the Switch is operating. You can use different transceivers to connect to Ethernet switches with different types of fiber-optic connectors.

- Type: SFP connection interface
- Connection speed: 1 Gigabit per second (Gbps)

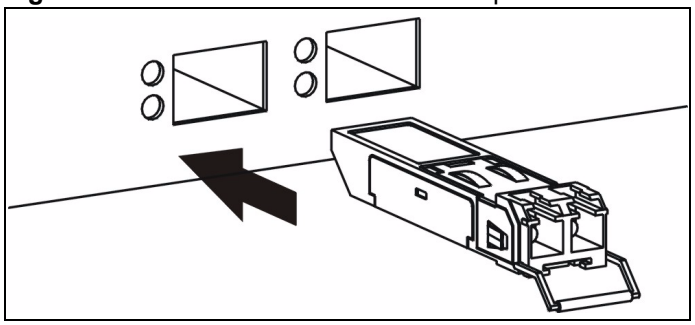
To avoid possible eye injury, do not look into an operating fiber-optic module's connectors.

3.1.3.1 Transceiver Installation

Use the following steps to install a mini GBIC transceiver or 100Mbps SFP transceivers.

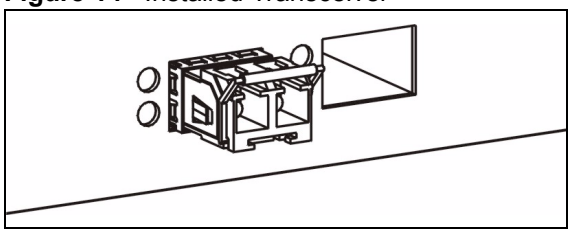
1. Insert the transceiver into the slot with the exposed section of PCB board facing down.

Figure 13 Transceiver Installation Example



2. Press the transceiver firmly until it clicks into place.
3. The Switch automatically detects the installed transceiver. Check the LEDs to verify that it is functioning properly.

Figure 14 Installed Transceiver

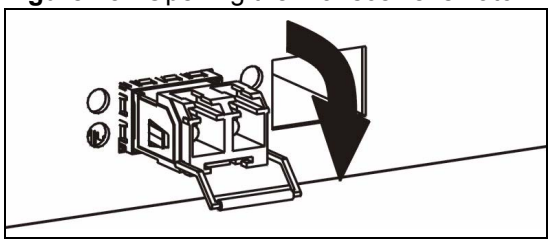


3.1.3.2 Transceiver Removal

Use the following steps to remove a mini GBIC transceiver (SFP module).

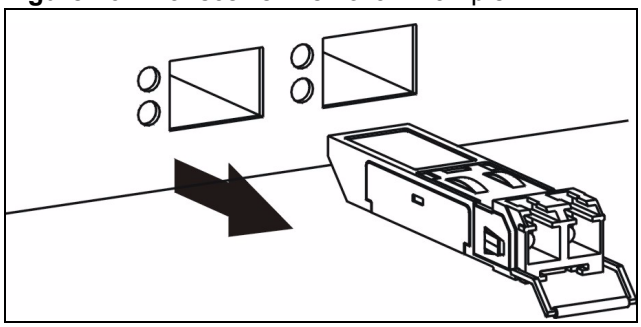
1 Open the transceiver's latch (latch styles vary).

Figure 15 Opening the Transceiver's Latch Example



2 Pull the transceiver out of the slot.

Figure 16 Transceiver Removal Example



3.2 Rear Panel

The following figure shows the rear panel of the Switch. The rear panel contains the connector for external backup power supply (BPS), the power receptacle, and the power switch (DC models only).

Figure 17 Rear Panel (AC models)

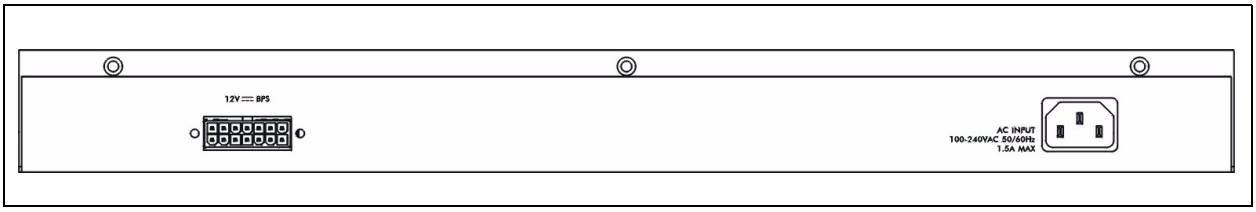
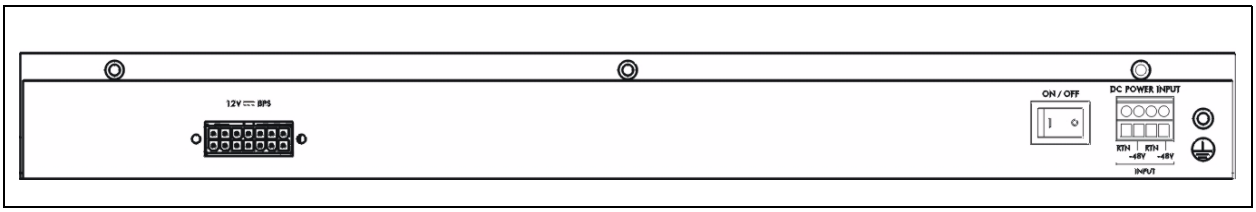


Figure 18 Rear Panel (DC models)



3.2.1 Power Connector

Make sure you are using the correct power source as shown on the panel.

To connect the power to the Switch, insert the female end of power cord to the power receptacle on the rear panel. Connect the other end of the supplied power cord to the power source. Make sure that no objects obstruct the airflow of the fans.

3.2.2 External Backup Power Supply Connector

The Switch supports external backup power supply (BPS).

The backup power supply constantly monitors the status of the internal power supply. The backup power supply automatically provides power to the Switch in the event of a power failure. Once the Switch receives power from the backup power supply, it will not automatically switch back to using the internal power supply even when the power is resumed.

3.3 LEDs

The following table describes the LEDs.

Table 3 LEDs

LED	COLOR	STATUS	DESCRIPTION
BPS	Green	Blinking	The Switch is receiving power from the backup power supply.
		On	The backup power supply is connected and active.
		Off	The backup power supply is not ready or not active.
PWR	Green	On	The Switch is turned on.
		Off	The Switch is off.
SYS	Green	Blinking	The Switch is rebooting and performing self-diagnostic tests.
		On	The Switch is on and functioning properly.
		Off	The power is off or the Switch is not ready/malfunctioning.
ALM	Red	On	There is a hardware failure.
		Off	The Switch is functioning normally.
Ethernet ports (ES-3124 and ES-3124-4F only)			

Table 3 LEDs (continued)

LED	COLOR	STATUS	DESCRIPTION
LNK/ACT	Green	Blinking	The Switch is transmitting/receiving to/from a 10 Mbps Ethernet network.
		On	The link to a 10 Mbps Ethernet network is up.
	Amber	Blinking	The Switch is transmitting/receiving to/from a 100 Mbps Ethernet network.
		On	The link to a 100 Mbps Ethernet network is up.
		Off	The link to an Ethernet network is down.
FDX	Amber	On	The port is negotiating in full-duplex mode.
		Off	The port is negotiating in half-duplex mode and no collisions are occurring.
Ethernet ports (ES-3124PWR only)			
LNK/ACT	Green	Blinking	The Switch is transmitting/receiving to/from a 10 Mbps Ethernet network.
		On	The link to a 10 Mbps Ethernet network is up.
	Amber	Blinking	The Switch is transmitting/receiving to/from a 100 Mbps Ethernet network.
		On	The link to a 100 Mbps Ethernet network is up.
		Off	The link to an Ethernet network is down.
PoE	Amber	On	The Switch is supplying power to the connected device that supports PoE.
		Off	No device is connected to this port or the Switch is not supplying power via the Ethernet cable.
100Mbps SFP ports (ES-3124F only)			
LNK	Amber	On	The port has a successful connection.
		Off	No Ethernet device is connected to this port.
ACT	Amber	Blinking	The port is receiving or transmitting data.
Gigabit Port			
LNK/ACT	Green	Blinking	The Switch is transmitting/receiving to/from a 1000 Mbps Ethernet network.
		On	The link to a 1000 Mbps Ethernet network is up.
	Amber	Blinking	The Switch is transmitting/receiving to/from a 100 Mbps Ethernet network.
		On	The link to a 100 Mbps Ethernet network is up.
		Off	The link to an Ethernet network is down.
FDX	Amber	On	The Gigabit port is negotiating in full-duplex mode.
		Off	The Gigabit port is negotiating in half-duplex mode and no collisions are occurring.
Mini-GBIC Ports			
LNK	Green	On	The port has a successful connection.
		Off	No Ethernet device is connected to this port.
ACT	Green	Blinking	The port is receiving or transmitting data.
MGMT			

Table 3 LEDs (continued)

LED	COLOR	STATUS	DESCRIPTION
10	Green	Blinking	The Switch is transmitting/receiving to/from an Ethernet device.
		On	The port is connected at 10 Mbps.
		Off	The port is not connected at 10 Mbps or to an Ethernet device.
100	Amber	Blinking	The Switch is transmitting/receiving to/from an Ethernet device.
		On	The port is connected at 100 Mbps.
		Off	The port is not connected at 100 Mbps or to an Ethernet device.

PART III
Web Configurator

The Web Configurator (55)
Initial Setup Example (65)
System Status and Port Statistics (69)
Basic Setting (75)
VLAN (87)
Static MAC Forward Setup (105)
Filtering (107)
Spanning Tree Protocol (109)
Bandwidth Control (127)
Broadcast Storm Control (129)
Mirroring (131)
Link Aggregation (133)
Port Authentication (141)
Port Security (147)
Classifier (151)
Policy Rule (157)
Queuing Method (163)
VLAN Stacking (167)
Multicast (173)
Authentication & Accounting (187)
IP Source Guard (201)
Loop Guard (221)
Static Routing (225)

Differentiated Services (227)
DHCP (235)
Maintenance (241)
Access Control (247)
Diagnostic (267)
Syslog (269)
Cluster Management (273)
MAC Table (279)
ARP Table (281)
Configure Clone (283)

4

The Web Configurator

This section introduces the configuration and functions of the web configurator.

4.1 Introduction

The web configurator is an HTML-based management interface that allows easy Switch setup and management via Internet browser. Use Internet Explorer 6.0 and later or Netscape Navigator 7.0 and later versions. The recommended screen resolution is 1024 by 768 pixels.

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device. Web pop-up blocking is enabled by default in Windows XP SP (Service Pack) 2.
- JavaScript (enabled by default).
- Java permissions (enabled by default).

4.2 System Login

1. Start your web browser.
2. Type “http://” and the IP address of the Switch (for example, the default is 192.168.1.1) in the Location or Address field. Press [ENTER].
3. The login screen appears. The default username is **admin** and associated default password is **1234**. The date and time display as shown if you have not configured a time server nor manually entered a time and date in the **General Setup** screen.

Figure 19 Web Configurator: Login



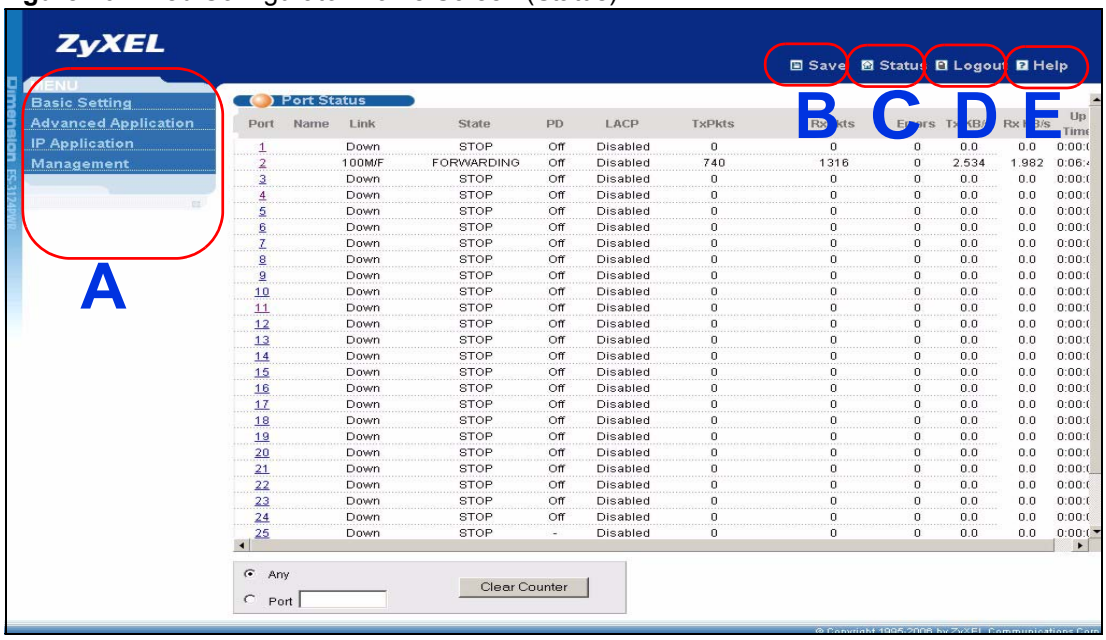
4 Click **OK** to view the first web configurator screen.

4.3 The Status Screen

The **Status** screen is the first screen that displays when you access the web configurator.

The following figure shows the navigating components of a web configurator screen.

Figure 20 Web Configurator Home Screen (Status)



A - Click the menu items to open submenu links, and then click on a submenu link to open the screen in the main window.

B, **C**, **D**, **E** - These are quick links which allow you to perform certain tasks no matter which screen you are currently working in.

B - Click this link to save your configuration into the Switch's nonvolatile memory. Nonvolatile memory is saved in the configuration file from which the Switch booted from and it stays the same even if the Switch's power is turned off. See Section 29.3 on page 242 for information on saving your settings to a specific configuration file.

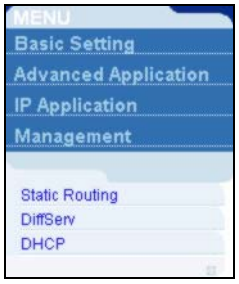
C - Click this link to go to the status page of the Switch.

D - Click this link to logout of the web configurator.

E - Click this link to display web help pages. The help pages provide descriptions for all of the configuration screens.

In the navigation panel, click a main link to reveal a list of submenu links.

Table 4 Navigation Panel Sub-links Overview

BASIC SETTING	ADVANCED APPLICATION	IP APPLICATION	MANAGEMENT
			

The following table lists the various web configurator screens within the sub-links.

Table 5 Web Configurator Screen Sub-links Details

BASIC SETTING	ADVANCED APPLICATION	IP APPLICATION	MANAGEMENT
System Info General Setup Switch Setup IP Setup Port Setup	VLAN Status VLAN Detail VLAN Port Setting Subnet Based VLAN Protocol Based VLAN Static VLAN Static MAC Forwarding Filtering Spanning Tree Protocol Status Spanning Tree Configuration Rapid Spanning Tree Protocol Multiple Rapid Spanning Tree Protocol Multiple Spanning Tree Protocol Bandwidth Control Broadcast Storm Control Mirroring Link Aggregation Status Link Aggregation Setting Link Aggregation Control Protocol Port Authentication 802.1x MAC Authentication Port Security Classifier Policy Rule Queuing Method VLAN Stacking Multicast Status Multicast Setting IGMP Snooping VLAN IGMP Filtering Profile MVR Group Configuration	Static Routing DiffServ 2-rate 3 Color Marker DSCP Setting DHCP Status DHCP Relay VLAN Setting	Maintenance Firmware Upgrade Restore Configuration Backup Configuration Access Control SNMP Trap Group Logins Service Access Control Remote Management Diagnostic Syslog Setup Syslog Server Setup Cluster Management Status Clustering Management Configuration MAC Table ARP Table Configure Clone

Table 5 Web Configurator Screen Sub-links Details (continued)

BASIC SETTING	ADVANCED APPLICATION	IP APPLICATION	MANAGEMENT
	Authentication and Accounting RADIUS Server Setup TACACS+ Server Setup Auth and Acct Setup IP Source Guard IP Source Guard Static Binding DHCP Snooping DHCP Snooping Configure DHCP Snooping Port Configure DHCP Snooping VLAN Configure ARP Inspection Status ARP Inspection Log Status ARP Inspection Configure ARP Inspection Port Configure ARP Inspection VLAN Configure Loopguard		

The following table describes the links in the navigation panel.

Table 6 Navigation Panel Links

LINK	DESCRIPTION
Basic Setting	
System Info	This link takes you to a screen that displays general system and hardware monitoring information.
General Setup	This link takes you to a screen where you can configure general identification information about the Switch.
Switch Setup	This link takes you to a screen where you can set up global Switch parameters such as VLAN type, MAC address learning, GARP and priority queues.
IP Setup	This link takes you to a screen where you can configure the management IP address, subnet mask (necessary for Switch management) and DNS (domain name server).
Port Setup	This link takes you to screens where you can configure settings for individual Switch ports.
Advanced Application	
VLAN	This link takes you to screens where you can configure port-based or 802.1Q VLAN (depending on what you configured in the Switch Setup menu). You can also configure a protocol based VLAN or a subnet based VLAN in these screens.
Static MAC Forwarding	This link takes you to screens where you can configure static MAC addresses for a port. These static MAC addresses do not age out.
Filtering	This link takes you to a screen to set up filtering rules.

Table 6 Navigation Panel Links (continued)

LINK	DESCRIPTION
Spanning Tree Protocol	This link takes you to screens where you can configure the RSTP/MRSTP/MSTP to prevent network loops.
Bandwidth Control	This link takes you to screens where you can cap the maximum bandwidth allowed from specified source(s) to specified destination(s).
Broadcast Storm Control	This link takes you to a screen to set up broadcast filters.
Mirroring	This link takes you to screens where you can copy traffic from one port or ports to another port in order that you can examine the traffic from the first port without interference
Link Aggregation	This link takes you to a screen where you can logically aggregate physical links to form one logical, higher-bandwidth link.
Port Authentication	This link takes you to a screen where you can configure IEEE 802.1x port authentication as well as MAC authentication for clients communicating via the Switch.
Port Security	This link takes you to a screen where you can activate MAC address learning and set the maximum number of MAC addresses to learn on a port.
Classifier	This link takes you to a screen where you can configure the Switch to group packets based on the specified criteria.
Policy Rule	This link takes you to a screen where you can configure the Switch to perform special treatment on the grouped packets.
Queuing Method	This link takes you to a screen where you can configure queuing with associated queue weights for each port.
VLAN Stacking	This link takes you to a screen where you can configure VLAN stacking.
Multicast	This link takes you to a screen where you can configure various multicast features and create multicast VLANs.
Auth and Acct	This link takes you to a screen where you can configure authentication and accounting services via external servers. The external servers can be either RADIUS (Remote Authentication Dial-In User Service) or TACACS+ (Terminal Access Controller Access-Control System Plus).
IP Source Guard	This link takes you to a screen where you can configure filtering of unauthorized DHCP and ARP packets in your network.
Loop Guard	This link takes you to a screen where you can configure protection against network loops that occur on the edge of your network.
IP Application	
Static Route	This link takes you to screens where you can configure static routes. A static route defines how the Switch should forward traffic by configuring the TCP/IP parameters manually.
DiffServ	This link takes you to screens where you can enable DiffServ, configure marking rules and set DSCP-to-IEEE802.1p mappings.
DHCP	This link takes you to a screen where you can configure the DHCP settings.
Management	
Maintenance	This link takes you to screens where you can perform firmware and configuration file maintenance as well as reboot the system.
Access Control	This link takes you to screens where you can change the system login password and configure SNMP and remote management.
Diagnostic	This link takes you to screens where you can view system logs and test port(s).

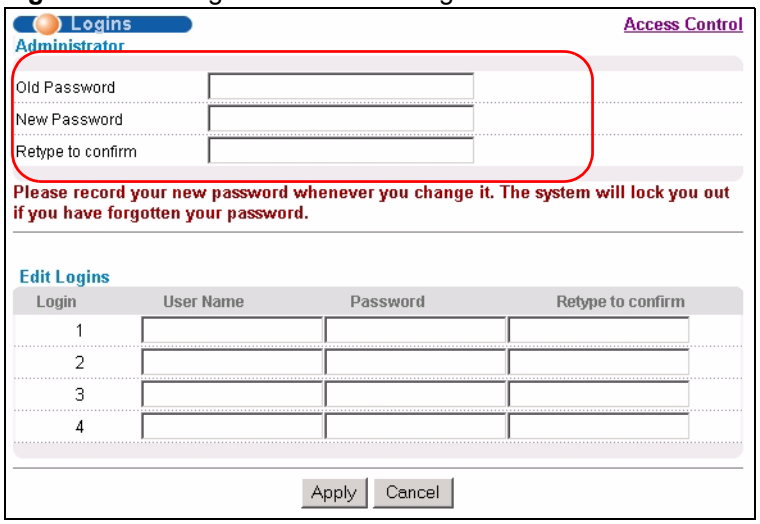
Table 6 Navigation Panel Links (continued)

LINK	DESCRIPTION
Syslog	This link takes you to screens where you can setup system logs and a system log server.
Cluster Management	This link takes you to a screen where you can configure clustering management and view its status.
MAC Table	This link takes you to a screen where you can view the MAC addresses (and types) of devices attached to what ports and VLAN IDs.
ARP Table	This link takes you to a screen where you can view the MAC addresses – IP address resolution table.
Configure Clone	This link takes you to a screen where you can copy attributes of one port to other ports.

4.3.1 Change Your Password

After you log in for the first time, it is recommended you change the default administrator password. Click **Management** > **Access Control > Logins** to display the next screen.

Figure 21 Change Administrator Login Password



4.4 Saving Your Configuration

When you are done modifying the settings in a screen, click **Apply** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the Switch's power is turned off.

Click the **Save** link in the upper right hand corner of the web configurator to save your configuration to nonvolatile memory. Nonvolatile memory refers to the Switch's storage that remains even if the Switch's power is turned off.



Use the **Save** link when you are done with a configuration session.

4.5 Switch Lockout

You could block yourself (and all others) from using in-band-management (managing through the data ports) if you do one of the following:

1. Delete the management VLAN (default is VLAN 1).
2. Delete all port-based VLANs with the CPU port as a member. The "CPU port" is the management port of the Switch.
3. Filter all traffic to the CPU port.
4. Disable all ports.
5. Misconfigure the text configuration file.
6. Forget the password and/or IP address.
7. Prevent all services from accessing the Switch.
8. Change a service port number but forget it.



Be careful not to lock yourself and others out of the Switch. If you do lock yourself out, try using out-of-band management (via the management port) to configure the Switch.

4.6 Resetting the Switch

If you lock yourself (and others) from the Switch or forget the administrator password, you will need to reload the factory-default configuration file.

4.6.1 Reload the Configuration File

Uploading the factory-default configuration file replaces the current configuration file with the factory-default configuration file. This means that you will lose all previous configurations and the speed of the console port will be reset to the default of 9600bps with 8 data bit, no parity, one stop bit and flow control set to none. The password will also be reset to "1234" and the IP address to 192.168.1.1.

To upload the configuration file, do the following:

1. Connect to the console port using a computer with terminal emulation software. See Section 3.1.1 on page 47 for details.
2. Disconnect and reconnect the Switch's power to begin a session. When you reconnect the Switch's power, you will see the initial screen.

3 When you see the message "`Press any key to enter Debug Mode within 3 seconds ...`" press any key to enter debug mode.
4 Type `atlc` after the "`Enter Debug Mode`" message.
5 Wait for the "`Starting XMODEM upload`" message before activating XMODEM upload on your terminal.
6 After a configuration file upload, type `atgo` to restart the Switch.

Figure 22 Resetting the Switch: Via the Console Port

```
Bootbase Version: V0.7 | 02/17/2006 11:56:33
RAM:Size = 64 Mbytes
DRAM POST: Testing: 65536K OK
DRAM Test SUCCESS !
FLASH: Intel 32M

ZyNOS Version: V3.80(AIC.0)b0 | 01/19/2007 19:06:37

Press any key to enter debug mode within 3 seconds.....................
Enter Debug Mode
ES-3124> atlc
Starting XMODEM upload (CRC mode)....
CCCCCCCCCCCCCCC
Total  393216 bytes received.
Erasing..
............................................................
OK
ES-3124> atgo
```

The Switch is now reinitialized with a default configuration file including the default password of "1234".

4.7 Logging Out of the Web Configurator

Click **Logout** in a screen to exit the web configurator. You have to log in with your password again after you log out. This is recommended after you finish a management session for security reasons.

Figure 23 Web Configurator: Logout Screen



4.8 Help

The web configurator's online help has descriptions of individual screens and some supplementary information.

Click the **Help** link from a web configurator screen to view an online help description of that screen.

5

Initial Setup Example

This chapter shows how to set up the Switch for an example network.

5.1 Overview

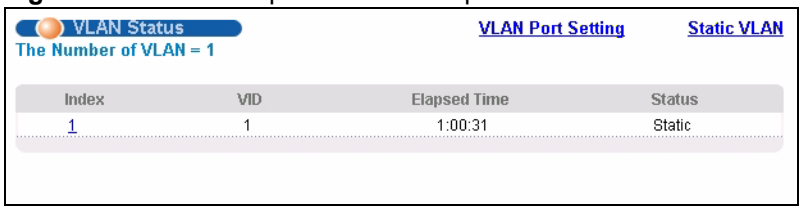
The following lists the configuration steps for the initial setup:

- Create a VLAN
- Set port VLAN ID
- Configure the Switch IP management address

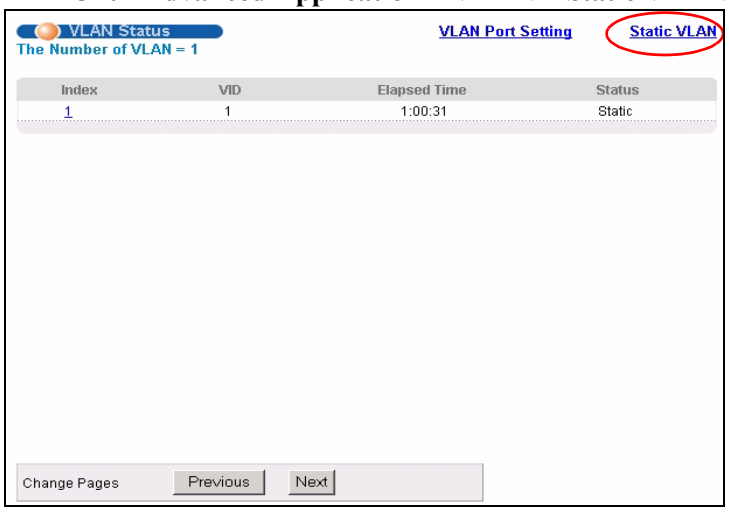
5.1.1 Creating a VLAN

VLANs confine broadcast frames to the VLAN group in which the port(s) belongs. You can do this with port-based VLAN or tagged static VLAN with fixed port members. In this example, you want to configure port 1 as a member of VLAN 2.

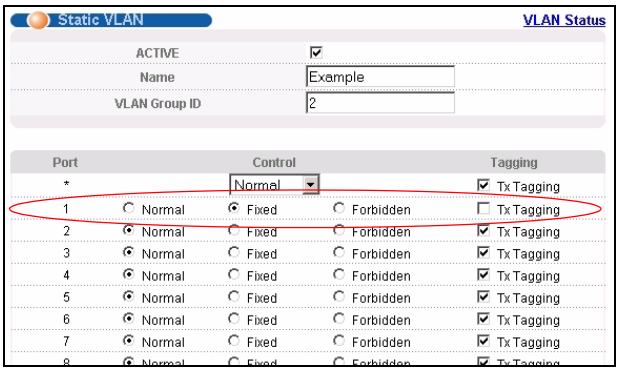
Figure 24 Initial Setup Network Example: VLAN



1 Click **Advanced Application > VLAN > Static VLAN**.



2 In the **Static VLAN** screen, select **ACTIVE**, enter a descriptive name in the **Name** field, and enter 2 in the **VLAN Group ID** field for the **VLAN2** network.



The **VLAN Group ID** field in this screen and the **VID** field in the **IP Setup** screen refer to the same VLAN ID.

3 Since the **VLAN2** network is connected to port 1 on the Switch, select **Fixed** to configure port 1 to be a permanent member of the VLAN only.

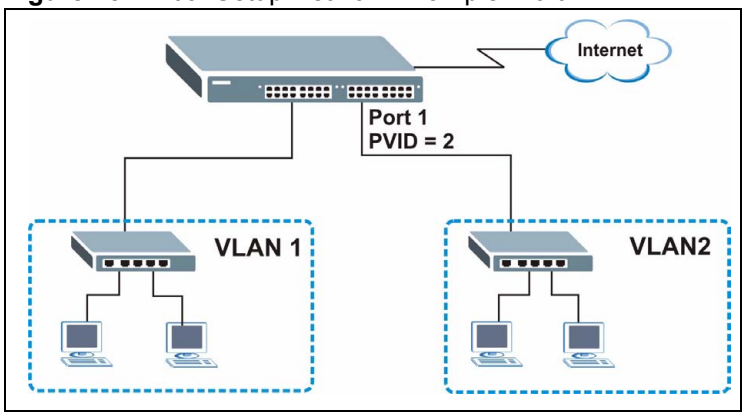
4 To ensure that VLAN-unaware devices (such as computers and hubs) can receive frames properly, clear the **TX Tagging** check box to set the Switch to remove VLAN tags before sending.

5 Click **Add** to save the settings to the run-time memory. Settings in the run-time memory are lost when the Switch's power is turned off.

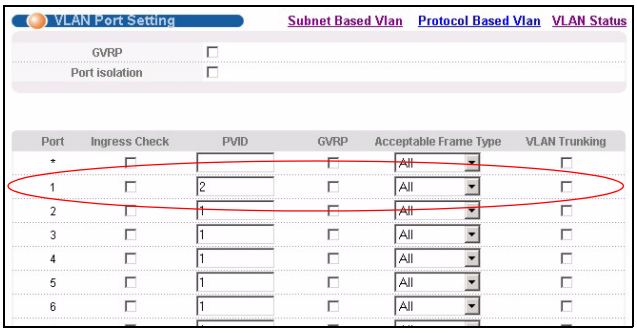
5.1.2 Setting Port VID

Use PVID to add a tag to incoming untagged frames received on that port so that the frames are forwarded to the VLAN group that the tag defines. In the example network, configure 2 as the port VID on port 1 so that any untagged frames received on that port get sent to VLAN 2.

Figure 25 Initial Setup Network Example: Port VID



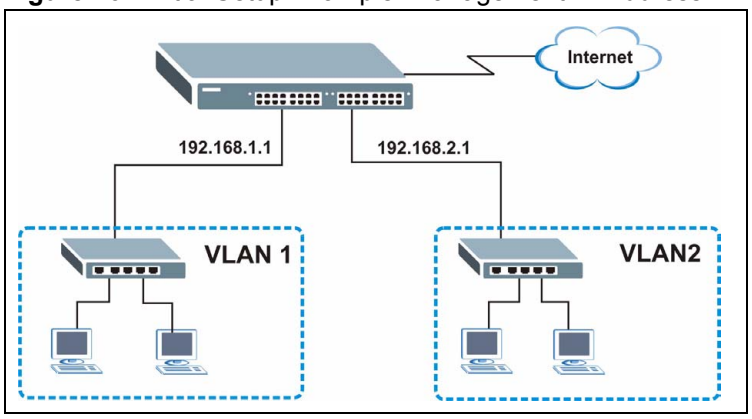
1. Click **Advanced Application > VLAN > VLAN Port Setting**.
2. Enter 2 in the **PVID** field for port 1, and click **Apply** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the Switch's power is turned off.



5.2 Configuring Switch Management IP Address

The default management IP address of the Switch is 192.168.1.1. You can configure another IP address in a different subnet for management purposes. The following figure shows an example.

Figure 26 Initial Setup Example: Management IP Address



1. Connect your computer to any Ethernet port on the Switch. Make sure your computer is in the same subnet as the Switch.
2. Open your web browser and enter 192.168.1.1 (the default IP address) in the address bar to access the web configurator. See Section 4.2 on page 55 for more information.

3 Click **Basic Setting > IP Setup**.

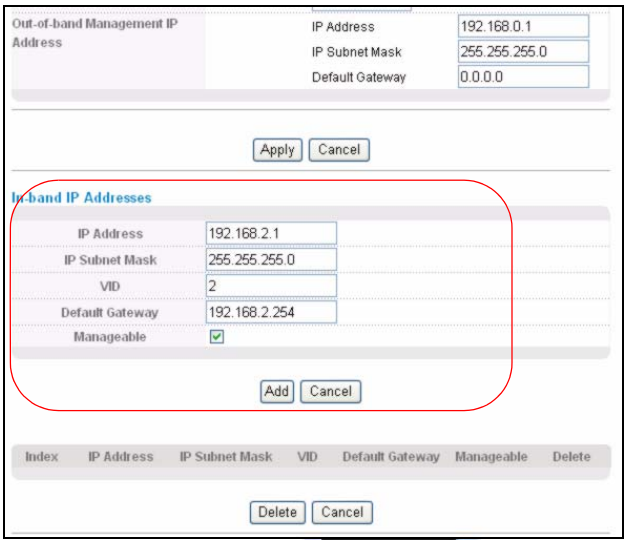
4 Configure the related fields in the **IP Setup** screen.

For the **VLAN2** network, enter 192.168.2.1 as the IP address and 255.255.255.0 as the subnet mask.

5 In the **VID** field, enter the ID of the VLAN group to which you want this management IP address to belong. This is the same as the VLAN ID you configure in the **Static VLAN** screen.

6 Select the **Manageable** check box to allow the Switch to be managed from the ports belonging to **VLAN2** using this specified IP address.

7 Repeat this process for **VLAN1**, if necessary.



Click **Add** to save your changes back to the run-time memory. Settings in the run-time memory are lost when the Switch's power is turned off.

6

System Status and Port Statistics

This chapter describes the system status (web configurator home page) and port details screens.

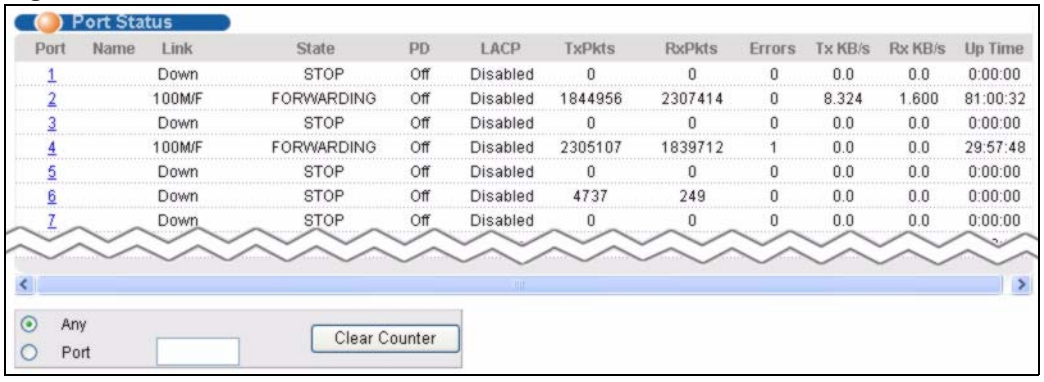
6.1 Overview

The home screen of the web configurator displays a port statistical summary with links to each port showing statistical details.

6.2 Port Status Summary

To view the port statistics, click **Status** in all web configurator screens to display the **Status** screen as shown next.

Figure 27 Status


Port Status
Port Name Link State PD LACP TxPkts RxPkts Errors Tx KB/s Rx KB/s Up Time
1 Down STOP Off Disabled 0 0 0 0.0 0.0 0:00:00
2 100M/F FORWARDING Off Disabled 1844956 2307414 0 8.324 1.600 81:00:32
3 Down STOP Off Disabled 0 0 0 0.0 0.0 0:00:00
4 100M/F FORWARDING Off Disabled 2305107 1839712 1 0.0 0.0 29:57:48
5 Down STOP Off Disabled 0 0 0 0.0 0.0 0:00:00
6 Down STOP Off Disabled 4737 249 0 0.0 0.0 0:00:00
7 Down STOP Off Disabled 0 0 0 0.0 0.0 0:00:00
Any
Port
Clear Counter

The following table describes the labels in this screen.

Table 7 Status

LABEL	DESCRIPTION
Port	This identifies the Ethernet port. Click a port number to display the **Port Details** screen (refer to Figure 28 on page 71).
Name	This is the name you assigned to this port in the **Basic Setting** > **Port Setup** screen.
Link	This field displays the speed (either **10M** for 10Mbps, **100M** for 100Mbps or **1000M** for 1000Mbps) and the duplex (**F** for full duplex or **H** for half). It also shows the cable type (**Copper** or **Fiber**) for the combo ports.

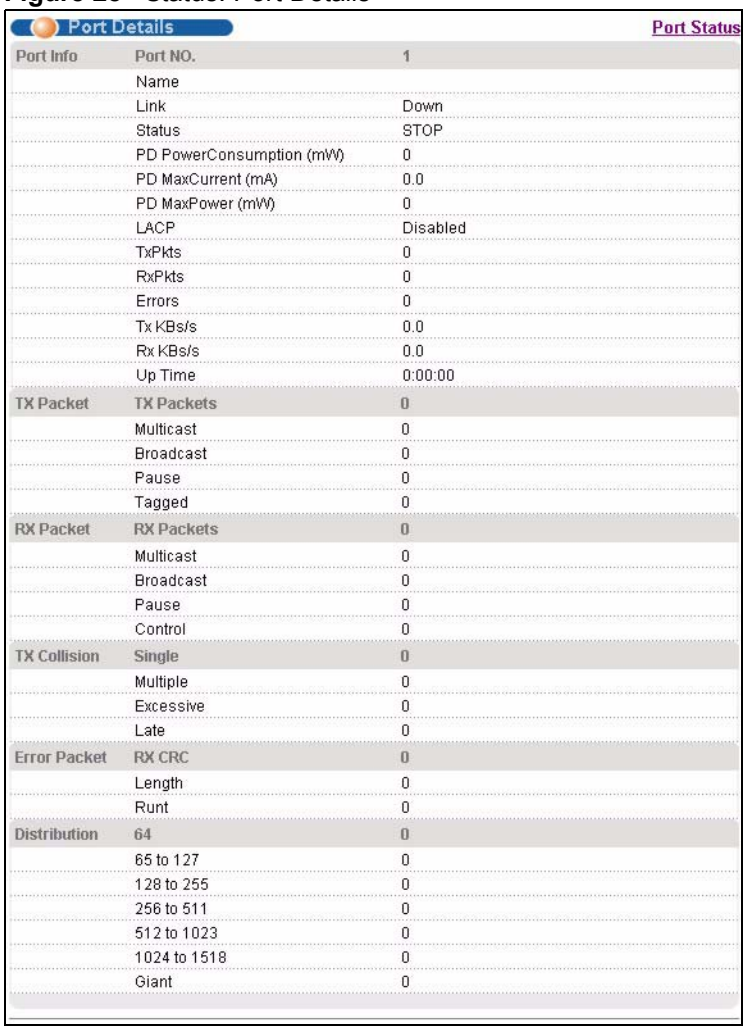
Table 7 Status (continued)

LABEL	DESCRIPTION
State	If STP (Spanning Tree Protocol) is enabled, this field displays the STP state of the port (see Section 11.1.3 on page 111 for more information). If STP is disabled, this field displays **FORWARDING** if the link is up, otherwise, it displays **STOP**.
PD (PWR models only)	If PoE (Power over Ethernet) is enabled on this port and a powered device (PD) is connected, this field displays **On**. If the PD is disconnected or PoE is disabled on this port, this field displays **Off**.
LACP	This fields displays whether LACP (Link Aggregation Control Protocol) has been enabled on the port.
TxPkts	This field shows the number of transmitted frames on this port.
RxPkts	This field shows the number of received frames on this port.
Errors	This field shows the number of received errors on this port.
Tx KB/s	This field shows the number of kilobytes per second transmitted on this port.
Rx KB/s	This field shows the number of kilobytes per second received on this port.
Up Time	This field shows the total amount of time in hours, minutes and seconds the port has been up.
Clear Counter	Enter a port number and then click **Clear Counter** to erase the recorded statistical information for that port, or select **Any** to clear statistics for all ports.

6.2.1 Status: Port Details

Click a number in the **Port** column in the **Status** screen to display individual port statistics. Use this screen to check status and detailed performance data about an individual port on the Switch.

Figure 28 Status: Port Details



Port Details — Port Status

Port Info	Port NO.	1
	Name	
	Link	Down
	Status	STOP
	PD PowerConsumption (mW)	0
	PD MaxCurrent (mA)	0.0
	PD MaxPower (mW)	0
	LACP	Disabled
	TxPkts	0
	RxPkts	0
	Errors	0
	Tx KBs/s	0.0
	Rx KBs/s	0.0
	Up Time	0:00:00
TX Packet	TX Packets	0
	Multicast	0
	Broadcast	0
	Pause	0
	Tagged	0
RX Packet	RX Packets	0
	Multicast	0
	Broadcast	0
	Pause	0
	Control	0
TX Collision	Single	0
	Multiple	0
	Excessive	0
	Late	0
Error Packet	RX CRC	0
	Length	0
	Runt	0
Distribution	64	0
	65 to 127	0
	128 to 255	0
	256 to 511	0
	512 to 1023	0
	1024 to 1518	0
	Giant	0

The following table describes the labels in this screen.

Table 8 Status > Port Details

LABEL	DESCRIPTION
Port Info	
Port NO.	This field displays the port number you are viewing.
Name	This field displays the name of the port.
Link	This field displays the speed (either **10M** for 10Mbps, **100M** for 100Mbps or **1000M** for 1000Mbps) and the duplex (**F** for full duplex or **H** for half duplex). It also shows the cable type (**Copper** or **Fiber**).
Status	If STP (Spanning Tree Protocol) is enabled, this field displays the STP state of the port (see Section 11.1.3 on page 111 for more information). If STP is disabled, this field displays FORWARDING if the link is up, otherwise, it displays STOP.
PD PowerConsumption (mW)	This field is available for PWR models only and is not available for the Gigabit and mini-GBIC ports. This field shows the power consumption of the powered device connected to the port.

Table 8 Status > Port Details (continued)

LABEL	DESCRIPTION
PD MaxCurrent (mA)	This field is available for PWR models only and is not available for the Gigabit and mini-GBIC ports. This field shows the maximum current a powered device can get from the Switch. If the powered device's power consumption exceeds the maximum power offered by the Switch, the Switch stops sending power. The Switch can provide up to 351.36mA current to one PD connected to each 10/100Mbps Ethernet port and up to a total of 123.2 W power to all PDs connected to the Switch.
PD MaxPower (mW)	This field is available for PWR models only and is not available for the Gigabit and mini-GBIC ports. This field shows the maximum power the Switch can provide through this port.
LACP	This field shows if LACP is enabled on this port or not.
TxPkts	This field shows the number of transmitted frames on this port
RxPkts	This field shows the number of received frames on this port
Errors	This field shows the number of received errors on this port.
Tx KB/s	This field shows the number kilobytes per second transmitted on this port.
Rx KB/s	This field shows the number of kilobytes per second received on this port.
Up Time	This field shows the total amount of time the connection has been up.
Tx Packet	The following fields display detailed information about packets transmitted.
TX Packets	This field shows the number of good packets (unicast, multicast and broadcast) transmitted.
Multicast	This field shows the number of good multicast packets transmitted.
Broadcast	This field shows the number of good broadcast packets transmitted.
Pause	This field shows the number of 802.3x Pause packets transmitted.
Tagged	This field shows the number of packets with VLAN tags transmitted.
Rx Packet	The following fields display detailed information about packets received.
RX Packets	This field shows the number of good packets (unicast, multicast and broadcast) received.
Multicast	This field shows the number of good multicast packets received.
Broadcast	This field shows the number of good broadcast packets received.
Pause	This field shows the number of 802.3x Pause packets received.
Control	This field shows the number of control packets received (including those with CRC error) but it does not include the 802.3x Pause packets.
TX Collision	The following fields display information on collisions while transmitting.
Single	This is a count of successfully transmitted packets for which transmission is inhibited by exactly one collision.
Multiple	This is a count of successfully transmitted packets for which transmission was inhibited by more than one collision.
Excessive	This is a count of packets for which transmission failed due to excessive collisions. Excessive collision is defined as the number of maximum collisions before the retransmission count is reset.
Late	This is the number of times a late collision is detected, that is, after 512 bits of the packets have already been transmitted.
Error Packet	The following fields display detailed information about packets received that were in error.

Table 8 Status > Port Details (continued)

LABEL	DESCRIPTION
RX CRC	This field shows the number of packets received with CRC (Cyclic Redundant Check) error(s).
Length	This field shows the number of packets received with a length that was out of range.
Runt	This field shows the number of packets received that were too short (shorter than 64 octets), including the ones with CRC errors.
Distribution	
64	This field shows the number of packets (including bad packets) received that were 64 octets in length.
65 to 127	This field shows the number of packets (including bad packets) received that were between 65 and 127 octets in length.
128 to 255	This field shows the number of packets (including bad packets) received that were between 128 and 255 octets in length.
256 to 511	This field shows the number of packets (including bad packets) received that were between 256 and 511 octets in length.
512 to 1023	This field shows the number of packets (including bad packets) received that were between 512 and 1023 octets in length.
1024 to 1518	This field shows the number of packets (including bad packets) received that were between 1024 and 1518 octets in length.
Giant	This field shows the number of packets dropped because they were bigger than the maximum frame size.

7

Basic Setting

This chapter describes how to configure the **System Info, General Setup**, **Switch Setup**, **IP Setup** and **Port Setup** screens.

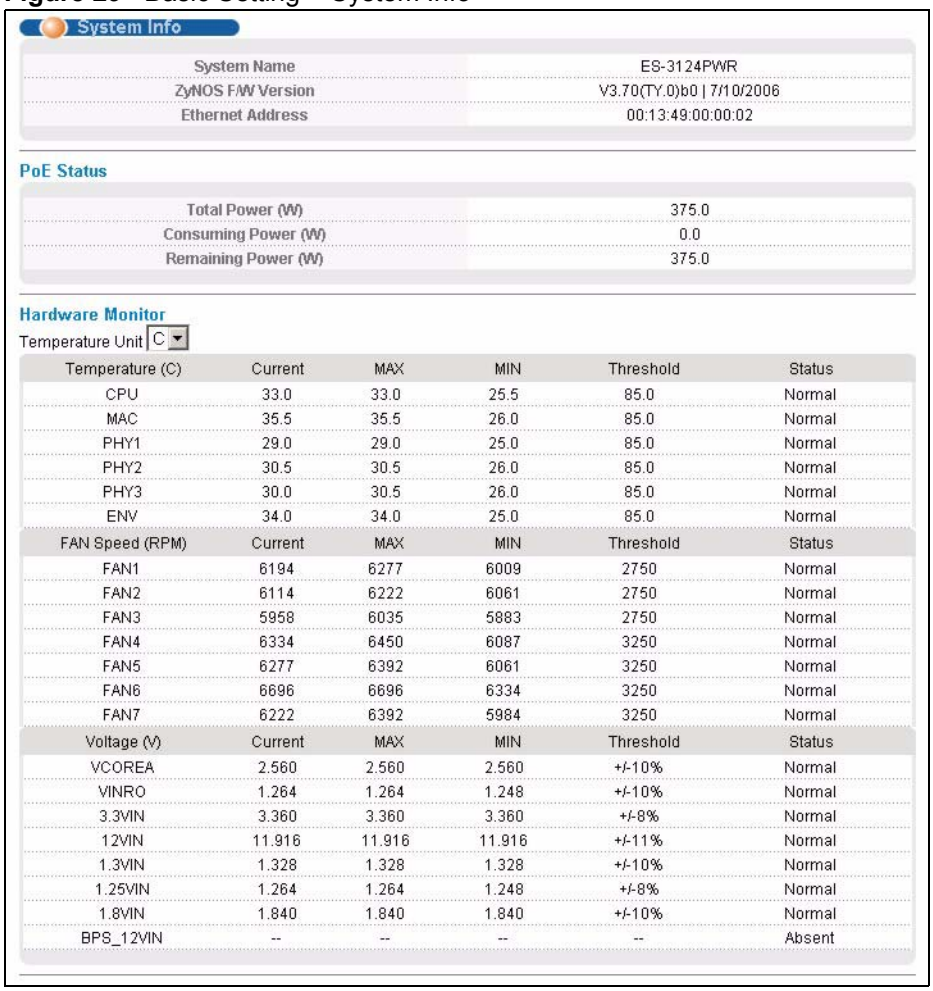
7.1 Overview

The **System Info** screen displays general Switch information (such as firmware version number) and hardware polling information (such as fan speeds). The **General Setup** screen allows you to configure general Switch identification information. The **General Setup** screen also allows you to set the system time manually or get the current time and date from an external server when you turn on your Switch. The real time is then displayed in the Switch logs. The **Switch Setup** screen allows you to set up and configure global Switch features. The **IP Setup** screen allows you to configure a Switch IP address, subnet mask(s) and DNS (domain name server) for management purposes.

7.2 System Information

In the navigation panel, click **Basic Setting** > **System Info** to display the screen as shown. You can check the firmware version number and monitor the Switch temperature, fan speeds and voltage in this screen.

Figure 29 Basic Setting > System Info


System Info
System Name ES-3124PWR
ZyNOS F/W Version V3.70(TY.0)b0 | 7/10/2006
Ethernet Address 00:13:49:00:00:02
PoE Status
Total Power (W) 375.0
Consuming Power (W) 0.0
Remaining Power (W) 375.0
Hardware Monitor
Temperature Unit C
Temperature (C) Current MAX MIN Threshold Status
CPU 33.0 33.0 25.5 85.0 Normal
MAC 35.5 35.5 26.0 85.0 Normal
PHY1 29.0 29.0 25.0 85.0 Normal
PHY2 30.5 30.5 26.0 85.0 Normal
PHY3 30.0 30.5 26.0 85.0 Normal
ENV 34.0 34.0 25.0 85.0 Normal
FAN Speed (RPM) Current MAX MIN Threshold Status
FAN1 6194 6277 6009 2750 Normal
FAN2 6114 6222 6061 2750 Normal
FAN3 5958 6035 5883 2750 Normal
FAN4 6334 6450 6087 3250 Normal
FAN5 6277 6392 6061 3250 Normal
FAN6 6696 6696 6334 3250 Normal
FAN7 6222 6392 5984 3250 Normal
Voltage (V) Current MAX MIN Threshold Status
VCOREA 2.560 2.560 2.560 +/-10% Normal
VINRO 1.264 1.264 1.248 +/-10% Normal
3.3VIN 3.360 3.360 3.360 +/-8% Normal
12VIN 11.916 11.916 11.916 +/-11% Normal
1.3VIN 1.328 1.328 1.328 +/-10% Normal
1.25VIN 1.264 1.264 1.248 +/-8% Normal
1.8VIN 1.840 1.840 1.840 +/-10% Normal
BPS_12VIN -- -- -- -- Absent

The following table describes the labels in this screen.

Table 9 Basic Setting > System Info

LABEL	DESCRIPTION
System Name	This field displays the descriptive name of the Switch for identification purposes.
ZyNOS F/W Version	This field displays the version number of the Switch 's current firmware including the date created.
Ethernet Address	This field refers to the Ethernet MAC (Media Access Control) address of the Switch.
PoE Status	This section is available on the PWR models only.
Total Power (W)	This is the total power in Watts the Switch can provide over the Ethernet.
Consuming Power (W)	This is the power consumed by PoE-compatible devices connected to the Switch.
Remaining Power (W)	This is the remaining power in Watts the Switch can provide over the Ethernet.
Hardware Monitor	

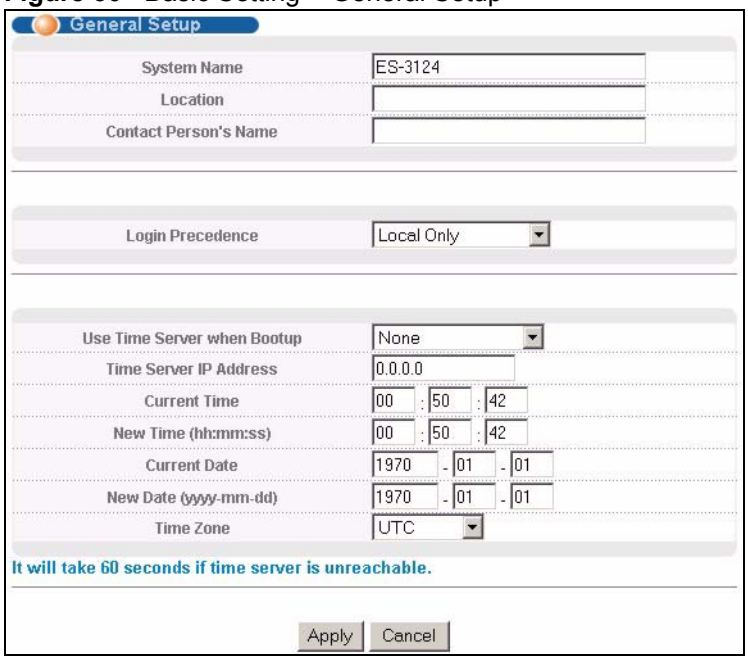
Table 9 Basic Setting > System Info (continued)

LABEL	DESCRIPTION
Temperature Unit	The Switch has temperature sensors that are capable of detecting and reporting if the temperature rises above the threshold. You may choose the temperature unit (Centigrade or Fahrenheit) in this field.
Temperature	**MAC**, **CPU** and **PHY** refer to the location of the temperature sensors on the Switch's printed circuit board. **ENV** refers to the environmental or ambient temperature within the Switch (PWR models only).
Current	This shows the current temperature at this sensor.
MAX	This field displays the maximum temperature measured at this sensor.
MIN	This field displays the minimum temperature measured at this sensor.
Threshold	This field displays the upper temperature limit at this sensor.
Status	This field displays **Normal** for temperatures below the threshold and **Error** for those above.
FAN Speed (RPM)	A properly functioning fan is an essential component (along with a sufficiently ventilated, cool operating environment) in order for the device to stay within the temperature threshold. Each fan has a sensor that is capable of detecting and reporting if the fan speed falls below the threshold shown.
Current	This field displays this fan's current speed in Revolutions Per Minute (RPM).
MAX	This field displays this fan's maximum speed measured in Revolutions Per Minute (RPM).
MIN	This field displays this fan's minimum speed measured in Revolutions Per Minute (RPM). "<41" is displayed for speeds too small to measure (under 2000 RPM).
Threshold	This field displays the minimum speed at which a normal fan should work.
Status	**Normal** indicates that this fan is functioning above the minimum speed. **Error** indicates that this fan is functioning below the minimum speed.
Voltage(V)	The power supply for each voltage has a sensor that is capable of detecting and reporting if the voltage falls out of the tolerance range.
Current	This is the current voltage reading.
MAX	This field displays the maximum voltage measured at this point.
MIN	This field displays the minimum voltage measured at this point.
Threshold	This field displays the percentage tolerance of the voltage with which the Switch still works.
Status	**Normal** indicates that the voltage is within an acceptable operating range at this point; otherwise **Error** is displayed.

7.3 General Setup

Use this screen to configure general settings such as the system name and time. Click **Basic Setting** and **General Setup** in the navigation panel to display the screen as shown.

Figure 30 Basic Setting > General Setup



The following table describes the labels in this screen.

Table 10 Basic Setting > General Setup

LABEL	DESCRIPTION
System Name	Choose a descriptive name for identification purposes. This name consists of up to 64 printable characters; spaces are allowed.
Location	Enter the geographic location of your Switch. You can use up to 32 printable ASCII characters; spaces are allowed.
Contact Person's Name	Enter the name of the person in charge of this Switch. You can use up to 32 printable ASCII characters; spaces are allowed.
Use Time Server when Bootup	Enter the time service protocol that your timeserver uses. Not all time servers support all protocols, so you may have to use trial and error to find a protocol that works. The main differences between them are the time format. When you select the **Daytime (RFC 867)** format, the Switch displays the day, month, year and time with no time zone adjustment. When you use this format it is recommended that you use a Daytime timeserver within your geographical time zone. **Time (RFC-868)** format displays a 4-byte integer giving the total number of seconds since 1970/1/1 at 0:0:0. **NTP (RFC-1305)** is similar to Time (RFC-868). **None** is the default value. Enter the time manually. Each time you turn on the Switch, the time and date will be reset to 1970-1-1 0:0.
Time Server IP Address	Enter the IP address of your timeserver. The Switch searches for the timeserver for up to 60 seconds. If you select a timeserver that is unreachable, then this screen will appear locked for 60 seconds. Please wait.
Current Time	This field displays the time you open this menu (or refresh the menu).
New Time (hh:min:ss)	Enter the new time in hour, minute and second format. The new time then appears in the **Current Time** field after you click **Apply**.
Current Date	This field displays the date you open this menu.
New Date (yyyy-mm-dd)	Enter the new date in year, month and day format. The new date then appears in the **Current Date** field after you click **Apply**.

Table 10 Basic Setting > General Setup (continued)

LABEL	DESCRIPTION
Time Zone	Select the time difference between UTC (Universal Time Coordinated, formerly known as GMT, Greenwich Mean Time) and your time zone from the drop-down list box.
Daylight Saving Time	Daylight saving is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening. Select this option if you use Daylight Saving Time.
Start Date	Configure the day and time when Daylight Saving Time starts if you selected **Daylight Saving Time**. The time is displayed in the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the second Sunday of March. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **Second**, **Sunday**, **March** and **2:00**. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **March** and the last field depends on your time zone. In Germany for instance, you would select **2:00** because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Date	Configure the day and time when Daylight Saving Time ends if you selected **Daylight Saving Time**. The time field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the first Sunday of November. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **First**, **Sunday**, **November** and **2:00**. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **October** and the last field depends on your time zone. In Germany for instance, you would select **2:00** because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

7.4 Introduction to VLANs

A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Devices on a logical network belong to one group. A device can belong to more than one group. With VLAN, a device cannot directly talk to or hear from devices that are not in the same group(s); the traffic must first go through a router.

In MTU (Multi-Tenant Unit) applications, VLAN is vital in providing isolation and security among the subscribers. When properly configured, VLAN prevents one subscriber from accessing the network resources of another on the same LAN, thus a user will not see the printers and hard disks of another user in the same building.

VLAN also increases network performance by limiting broadcasts to a smaller and more manageable logical broadcast domain. In traditional switched environments, all broadcast packets go to each and every individual port. With VLAN, all broadcasts are confined to a specific broadcast domain.

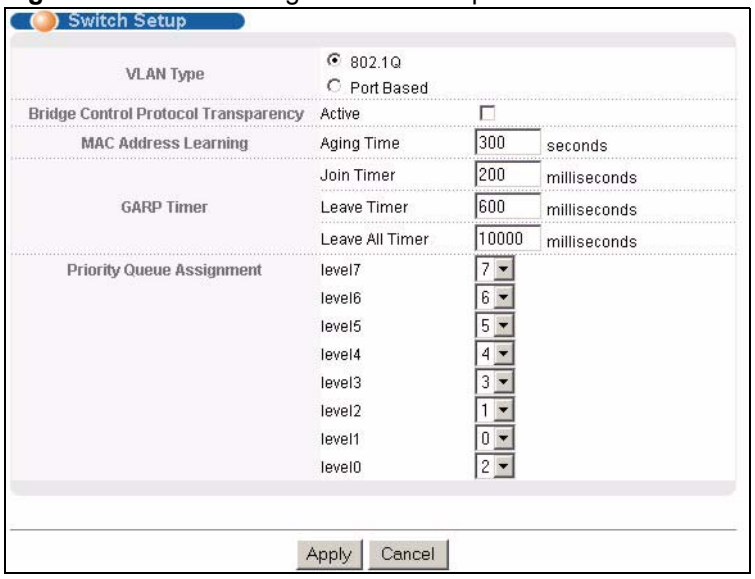
VLAN is unidirectional; it only governs outgoing traffic.

See Chapter 8 on page 87 for information on port-based and 802.1Q tagged VLANs.

7.5 Switch Setup Screen

Click **Basic Setting** and then **Switch Setup** in the navigation panel to display the screen as shown. The VLAN setup screens change depending on whether you choose **802.1Q** or **Port Based** in the **VLAN Type** field in this screen. Refer to the chapter on VLAN.

Figure 31 Basic Setting > Switch Setup



The following table describes the labels in this screen.

Table 11 Basic Setting > Switch Setup

LABEL	DESCRIPTION
VLAN Type	Choose **802.1Q** or **Port Based**. The **VLAN Setup** screen changes depending on whether you choose **802.1Q** VLAN type or **Port Based** VLAN type in this screen. See Chapter 8 on page 87 for more information.
Bridge Control Protocol Transparency	Select **Active** to allow the Switch to handle bridging control protocols (STP for example). You also need to define how to treat a BPDU in the **Port Setup** screen.
MAC Address Learning	MAC address learning reduces outgoing traffic broadcasts. For MAC address learning to occur on a port, the port must be active.

Table 11 Basic Setting > Switch Setup (continued)

LABEL	DESCRIPTION
Aging Time	Enter a time from 10 to 3000 seconds. This is how long all dynamically learned MAC addresses remain in the MAC address table before they age out (and must be relearned).
GARP Timer: Switches join VLANs by making a declaration. A declaration is made by issuing a **Join** message using GARP. Declarations are withdrawn by issuing a **Leave** message. A **Leave All** message terminates all registrations. GARP timers set declaration timeout values. See the chapter on VLAN setup for more background information.	
Join Timer	Join Timer sets the duration of the Join Period timer for GVRP in milliseconds. Each port has a **Join Period** timer. The allowed **Join Time** range is between 100 and 65535 milliseconds; the default is 200 milliseconds. See the chapter on VLAN setup for more background information.
Leave Timer	Leave Time sets the duration of the **Leave Period** timer for GVRP in milliseconds. Each port has a single **Leave Period** timer. Leave Time must be two times larger than **Join Timer**; the default is 600 milliseconds.
Leave All Timer	Leave All Timer sets the duration of the Leave All Period timer for GVRP in milliseconds. Each port has a single Leave All Period timer. Leave All Timer must be larger than Leave Timer.
Priority Queue Assignment IEEE 802.1p defines up to eight separate traffic types by inserting a tag into a MAC-layer frame that contains bits to define class of service. Frames without an explicit priority tag are given the default priority of the ingress port. Use the next two fields to configure the priority level-to-physical queue mapping. The Switch has eight physical queues that you can map to the 8 priority levels. On the Switch, traffic assigned to higher index queues gets through faster while traffic in lower index queues is dropped if the network is congested.	
Priority Level (The following descriptions are based on the traffic types defined in the IEEE 802.1d standard (which incorporates the 802.1p).	
Level 7	Typically used for network control traffic such as router configuration messages.
Level 6	Typically used for voice traffic that is especially sensitive to jitter (jitter is the variations in delay).
Level 5	Typically used for video that consumes high bandwidth and is sensitive to jitter.
Level 4	Typically used for controlled load, latency-sensitive traffic such as SNA (Systems Network Architecture) transactions.
Level 3	Typically used for “excellent effort” or better than best effort and would include important business traffic that can tolerate some delay.
Level 2	This is for “spare bandwidth”.
Level 1	This is typically used for non-critical “background” traffic such as bulk transfers that are allowed but that should not affect other applications and users.
Level 0	Typically used for best-effort traffic.
Apply	Click **Apply** to save your changes to the Switch’s run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

7.6 IP Setup

Use the **IP Setup** screen to configure the default gateway device, the default domain name server and add IP domains.

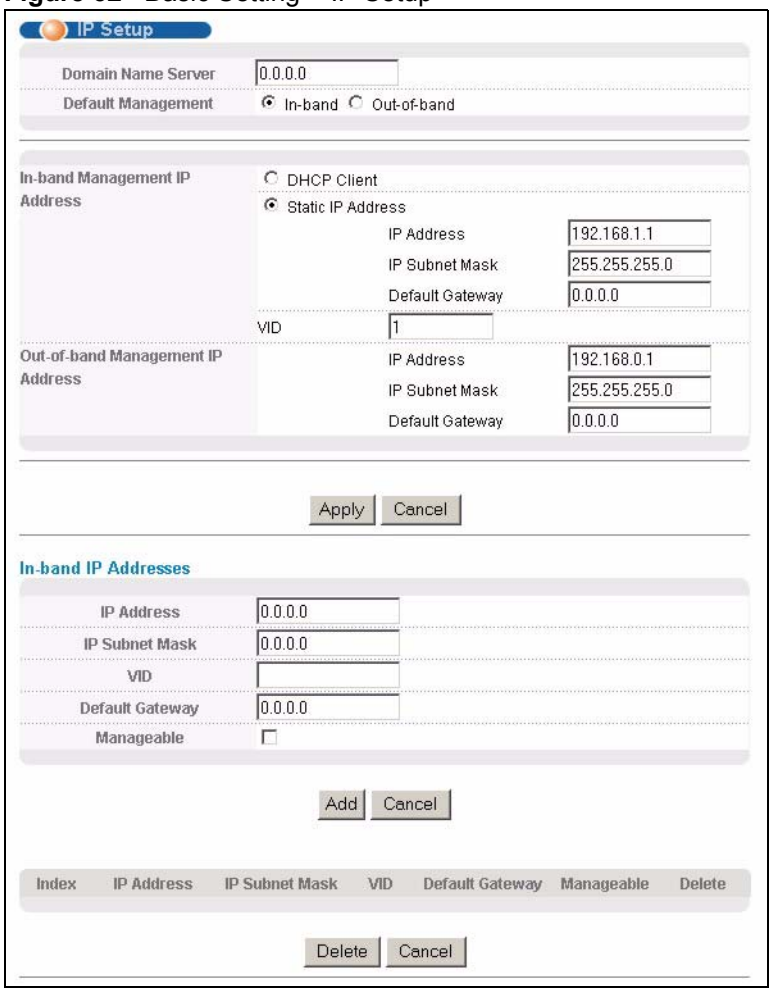
7.6.1 IP Interfaces

The Switch needs an IP address for it to be managed over the network. The factory default IP address is 192.168.1.1. The subnet mask specifies the network number portion of an IP address. The factory default subnet mask is 255.255.255.0.

You can configure IP addresses which are used to access and manage the Switch from the ports belonging to the pre-defined VLAN(s).

You must configure the VLAN first.

Figure 32 Basic Setting > IP Setup



The following table describes the labels in this screen.

Table 12 Basic Setting > IP Setup

LABEL	DESCRIPTION
Domain Name Server	DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. Enter a domain name server IP address in order to be able to use a domain name instead of an IP address.
Default Management	Specify which traffic flow (In-Band or Out-of-band) the Switch is to send packets originating from itself (such as SNMP traps) or packets with unknown source. Select **Out-of-band** to have the Switch send the packets to the out-of-band management port. This means that device(s) connected to the other port(s) do not receive these packets. Select **In-Band** to have the Switch send the packets to all ports except the out-of-band management port to which connected device(s) do not receive these packets.
In-band Management IP Address	
DHCP Client	Select this option if you have a DHCP server that can assign the Switch an IP address, subnet mask, a default gateway IP address and a domain name server IP address automatically.
Static IP Address	Select this option if you don't have a DHCP server or if you wish to assign static IP address information to the Switch. You need to fill in the following fields when you select this option.
IP Address	Enter the IP address of your Switch in dotted decimal notation for example 192.168.1.1.
IP Subnet Mask	Enter the IP subnet mask of your Switch in dotted decimal notation for example 255.255.255.0.
Default Gateway	Enter the IP address of the default outgoing gateway in dotted decimal notation, for example 192.168.1.254.
VID	Enter the VLAN identification number associated with the Switch IP address. VID is the VLAN ID of the CPU and is used for management only. The default is "1". All ports, by default, are fixed members of this "management VLAN" in order to manage the device from any port. If a port is not a member of this VLAN, then users on that port cannot access the device. To access the Switch make sure the port that you are connected to is a member of Management VLAN.
Out-of-band Management IP Address	
IP Address	Enter the IP address of your Switch in dotted decimal notation for example 192.168.0.1. If you change this IP address, make sure the computer connected to this management port is in the same subnet before accessing the Switch.
IP Subnet Mask	Enter the IP subnet mask of your Switch in dotted decimal notation for example 255.255.255.0.
Default Gateway	Enter the IP address of the default outgoing gateway in dotted decimal notation, for example 192.168.0.254.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields.
In-band IP Addresses	You can create IP addresses, which are used to access and manage the Switch from the ports belonging to the pre-defined VLAN(s). You must configure a VLAN first.
IP Address	Enter the IP address for managing the Switch by the members of the VLAN specified in the **VID** field below.
IP Subnet Mask	Enter the IP subnet mask in dotted decimal notation.

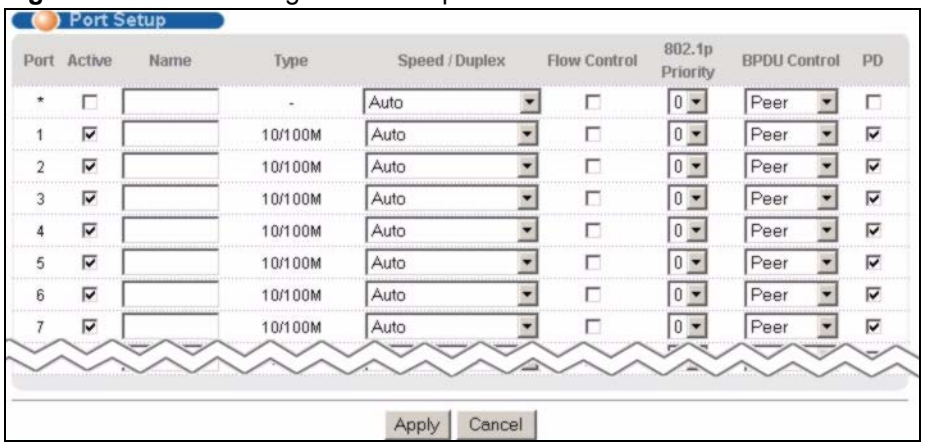
Table 12 Basic Setting > IP Setup (continued)

LABEL	DESCRIPTION
VID	Type the VLAN group identification number.
Default Gateway	Enter the IP address of the default outgoing gateway in dotted decimal notation.
Manageable	Select this option to allow the Switch to be managed using this specified IP address.
Add	Click **Add** to save the new rule to the Switch's run-time memory. It then displays in the summary table at the bottom of the screen.
Cancel	Click **Cancel** to reset the fields.
Index	This field displays the index number of an entry. Click an index number to edit the rule.
IP Address	This field displays the IP address.
IP Subnet Mask	This field displays the subnet mask.
VID	This field displays the VLAN identification number of the network.
Default Gateway	This field displays the IP address of the default outgoing gateway.
Manageable	This field displays whether the Switch can be managed using the specified IP address.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

7.7 Port Setup

Use this screen to configure Switch port settings. Click **Basic Setting** > **Port Setup** in the navigation panel to display the configuration screen.

Figure 33 Basic Setting > Port Setup



The following table describes the labels in this screen.

Table 13 Basic Setting > Port Setup

LABEL	DESCRIPTION
Port	This is the port index number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to enable a port. The factory default for all ports is enabled. A port must be enabled for data transmission to occur.
Name	Enter a descriptive name that identifies this port. You can enter up to 64 alpha-numerical characters. Note: Due to space limitation, the port name may be truncated in some web configurator screens.
Type	This field displays **10/100M** for an Ethernet/Fast Ethernet connection and **10/100/1000M** for Gigabit connections.
Speed/Duplex	Select the speed and the duplex mode of the Ethernet connection on this port. Choices are **Auto**, **10M/Half Duplex**, **10M/Full Duplex**, **100M/Half Duplex**, **100M/Full Duplex** and **1000M/Full Duplex** (for Gigabit ports only). Note: The connection type of an Fast Ethernet SFP port is fixed at **100M/Full Duplex**. Selecting **Auto** (auto-negotiation) allows one port to negotiate with a peer port automatically to obtain the connection speed and duplex mode that both ends support. When auto-negotiation is turned on, a port on the Switch negotiates with the peer automatically to determine the connection speed and duplex mode. If the peer port does not support auto-negotiation or turns off this feature, the Switch determines the connection speed by detecting the signal on the cable and using half duplex mode. When the Switch's auto-negotiation is turned off, a port uses the pre-configured speed and duplex mode when making a connection, thus requiring you to make sure that the settings of the peer port are the same in order to connect.
Flow Control	A concentration of traffic on a port decreases port bandwidth and overflows buffer memory causing packet discards and frame losses. **Flow Control** is used to regulate transmission of signals to match the bandwidth of the receiving port. The Switch uses IEEE 802.3x flow control in full duplex mode and backpressure flow control in half duplex mode. IEEE 802.3x flow control is used in full duplex mode to send a pause signal to the sending port, causing it to temporarily stop sending signals when the receiving port memory buffers fill. Back Pressure flow control is typically used in half duplex mode to send a "collision" signal to the sending port (mimicking a state of packet collision) causing the sending port to temporarily stop sending signals and resend later. Select **Flow Control** to enable it.
802.1p Priority	This priority value is added to incoming frames without a (802.1p) priority queue tag. See **Priority Queue Assignment** in Table 11 on page 80 for more information.

Table 13 Basic Setting > Port Setup (continued)

LABEL	DESCRIPTION
BPDU Control	Configure the way to treat BPDUs received on this port. You must activate bridging control protocol transparency in the **Switch Setup** screen first. Select **Peer** to process any BPDU (Bridge Protocol Data Units) received on this port. Select **Tunnel** to forward BPDUs received on this port. Select **Discard** to drop any BPDU received on this port. Select **Network** to process a BPDU with no VLAN tag and forward a tagged BPDU.
PD	This field is only available on the PWR models, but not available for the Gigabit or mini-GBIC ports. A powered device (PD) is a device such as an access point or a switch, that supports PoE (Power over Ethernet) so that it can receive power from another device through a 10/100Mbps Ethernet port. Select the check box to allow a powered device (connected to the port) to receive power from the Switch.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

8

VLAN

The type of screen you see here depends on the **VLAN Type** you selected in the **Switch Setup** screen. This chapter shows you how to configure 802.1Q tagged and port-based VLANs.

8.1 Introduction to IEEE 802.1Q Tagged VLANs

A tagged VLAN uses an explicit tag (VLAN ID) in the MAC header to identify the VLAN membership of a frame across bridges - they are not confined to the switch on which they were created. The VLANs can be created statically by hand or dynamically through GVRP. The VLAN ID associates a frame with a specific VLAN and provides the information that switches need to process the frame across the network. A tagged frame is four bytes longer than an untagged frame and contains two bytes of TPID (Tag Protocol Identifier, residing within the type/length field of the Ethernet frame) and two bytes of TCI (Tag Control Information, starts after the source address field of the Ethernet frame).

The CFI (Canonical Format Indicator) is a single-bit flag, always set to zero for Ethernet switches. If a frame received at an Ethernet port has a CFI set to 1, then that frame should not be forwarded as it is to an untagged port. The remaining twelve bits define the VLAN ID, giving a possible maximum number of 4,096 VLANs. Note that user priority and VLAN ID are independent of each other. A frame with VID (VLAN Identifier) of null (0) is called a priority frame, meaning that only the priority level is significant and the default VID of the ingress port is given as the VID of the frame. Of the 4096 possible VIDs, a VID of 0 is used to identify priority frames and value 4095 (FFF) is reserved, so the maximum possible VLAN configurations are 4,094.

TPID 2 Bytes	User Priority 3 Bits	CFI 1 Bit	VLAN ID 12 bits

8.1.1 Forwarding Tagged and Untagged Frames

Each port on the Switch is capable of passing tagged or untagged frames. To forward a frame from an 802.1Q VLAN-aware switch to an 802.1Q VLAN-unaware switch, the Switch first decides where to forward the frame and then strips off the VLAN tag. To forward a frame from an 802.1Q VLAN-unaware switch to an 802.1Q VLAN-aware switch, the Switch first decides where to forward the frame, and then inserts a VLAN tag reflecting the ingress port's default VID. The default PVID is VLAN 1 for all ports, but this can be changed.

A broadcast frame (or a multicast frame for a multicast group that is known by the system) is duplicated only on ports that are members of the VID (except the ingress port itself), thus confining the broadcast to a specific domain.

8.2 Automatic VLAN Registration

GARP and GVRP are the protocols used to automatically register VLAN membership across switches.

8.2.1 GARP

GARP (Generic Attribute Registration Protocol) allows network switches to register and de-register attribute values with other GARP participants within a bridged LAN. GARP is a protocol that provides a generic mechanism for protocols that serve a more specific application, for example, GVRP.

8.2.1.1 GARP Timers

Switches join VLANs by making a declaration. A declaration is made by issuing a Join message using GARP. Declarations are withdrawn by issuing a Leave message. A Leave All message terminates all registrations. GARP timers set declaration timeout values.

8.2.2 GVRP

GVRP (GARP VLAN Registration Protocol) is a registration protocol that defines a way for switches to register necessary VLAN members on ports across the network. Enable this function to permit VLAN groups beyond the local Switch.

Please refer to the following table for common IEEE 802.1Q VLAN terminology.

Table 14 IEEE 802.1Q VLAN Terminology

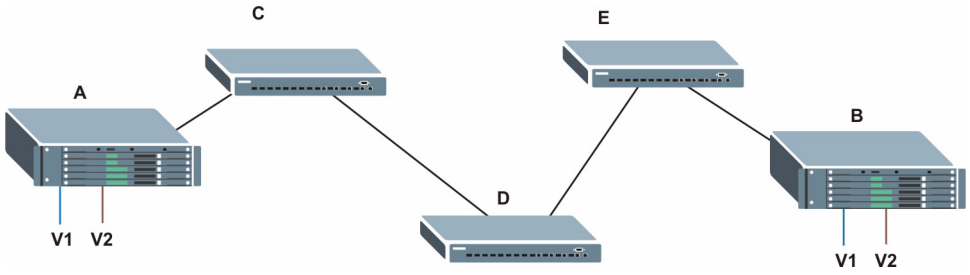
VLAN PARAMETER	TERM	DESCRIPTION
VLAN Type	Permanent VLAN	This is a static VLAN created manually.
	Dynamic VLAN	This is a VLAN configured by a GVRP registration/ deregistration process.
VLAN Administrative Control	Registration Fixed	Fixed registration ports are permanent VLAN members.
	Registration Forbidden	Ports with registration forbidden are forbidden to join the specified VLAN.
	Normal Registration	Ports dynamically join a VLAN using GVRP.
VLAN Tag Control	Tagged	Ports belonging to the specified VLAN tag all outgoing frames transmitted.
	Untagged	Ports belonging to the specified VLAN don't tag all outgoing frames transmitted.
VLAN Port	Port VID	This is the VLAN ID assigned to untagged frames that this port received.
	Acceptable Frame Type	You may choose to accept both tagged and untagged incoming frames, just tagged incoming frames or just untagged incoming frames on a port.
	Ingress filtering	If set, the Switch discards incoming frames for VLANs that do not have this port as a member

8.3 Port VLAN Trunking

Enable **VLAN Trunking** on a port to allow frames belonging to unknown VLAN groups to pass through that port. This is useful if you want to set up VLAN groups on end devices without having to configure the same VLAN groups on intermediary devices.

Refer to the following figure. Suppose you want to create VLAN groups 1 and 2 (V1 and V2) on devices A and B. Without **VLAN Trunking,** you must configure VLAN groups 1 and 2 on all intermediary switches C, D and E; otherwise they will drop frames with unknown VLAN group tags. However, with **VLAN Trunking** enabled on a port(s) in each intermediary switch you only need to create VLAN groups in the end devices (A and B). C, D and E automatically allow frames with VLAN group tags 1 and 2 (VLAN groups that are unknown to those switches) to pass through their VLAN trunking port(s).

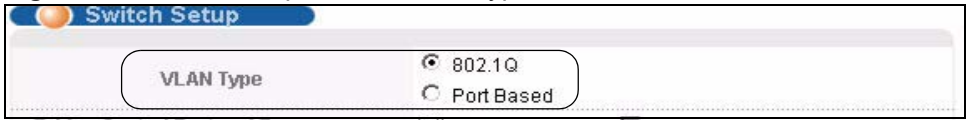
Figure 34 Port VLAN Trunking



8.4 Select the VLAN Type

Select a VLAN type in the **Basic Setting > Switch Setup** screen.

Figure 35 Switch Setup: Select VLAN Type



8.5 Static VLAN

Use a static VLAN to decide whether an incoming frame on a port should be

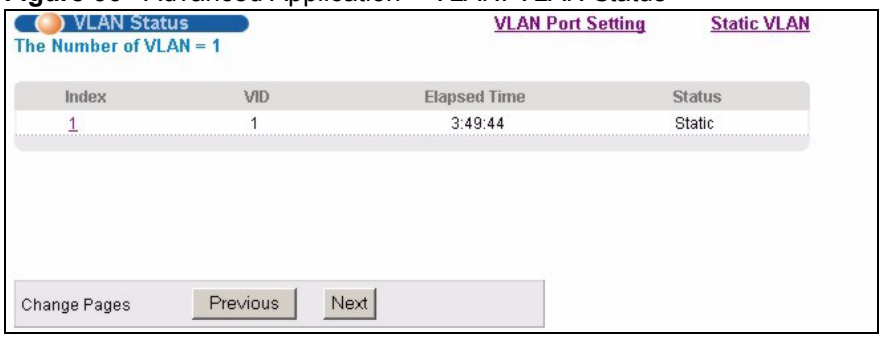
- sent to a VLAN group as normal depending on its VLAN tag.
- sent to a group whether it has a VLAN tag or not.
- blocked from a VLAN group regardless of its VLAN tag.

You can also tag all outgoing frames (that were previously untagged) from a port with the specified VID.

8.5.1 Static VLAN Status

See Section 8.1 on page 87 for more information on Static VLAN. Click **Advanced Application** > **VLAN** from the navigation panel to display the **VLAN Status** screen as shown next.

Figure 36 Advanced Application > VLAN: VLAN Status



The following table describes the labels in this screen.

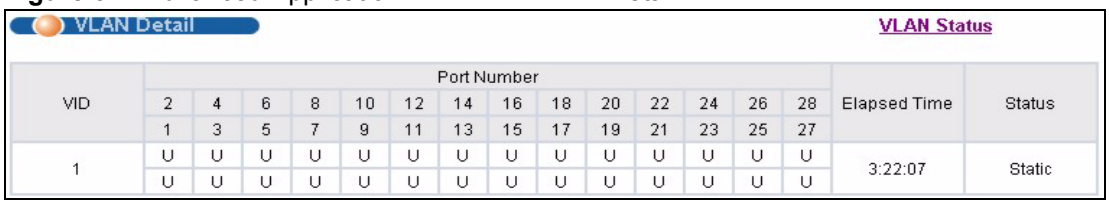
Table 15 Advanced Application > VLAN: VLAN Status

LABEL	DESCRIPTION
The Number of VLAN	This is the number of VLANs configured on the Switch.
Index	This is the VLAN index number. Click on an index number to view more VLAN details.
VID	This is the VLAN identification number that was configured in the **Static VLAN** screen.
Elapsed Time	This field shows how long it has been since a normal VLAN was registered or a static VLAN was set up.
Status	This field shows how this VLAN was added to the Switch; **dynamic** - using GVRP, **static** - added as a permanent entry or **other** - added in another way such as via Multicast VLAN Registration (MVR).
Change Pages	Click **Previous** or **Next** to show the previous/next screen if all status information cannot be seen in one screen.

8.5.2 Static VLAN Details

Use this screen to view detailed port settings and status of the VLAN group. See Section 8.1 on page 87 for more information on static VLAN. Click on an index number in the **VLAN Status** screen to display VLAN details.

Figure 37 Advanced Application > VLAN > VLAN Detail


VLAN Detail
VLAN Status
VID
Port Number
2 4 6 8 10 12 14 16 18 20 22 24 26 28
1 3 5 7 9 11 13 15 17 19 21 23 25 27
Elapsed Time
Status
1
U U U U U U U U U U U U U U
U U U U U U U U U U U U U U
3:22:07
Static

The following table describes the labels in this screen.

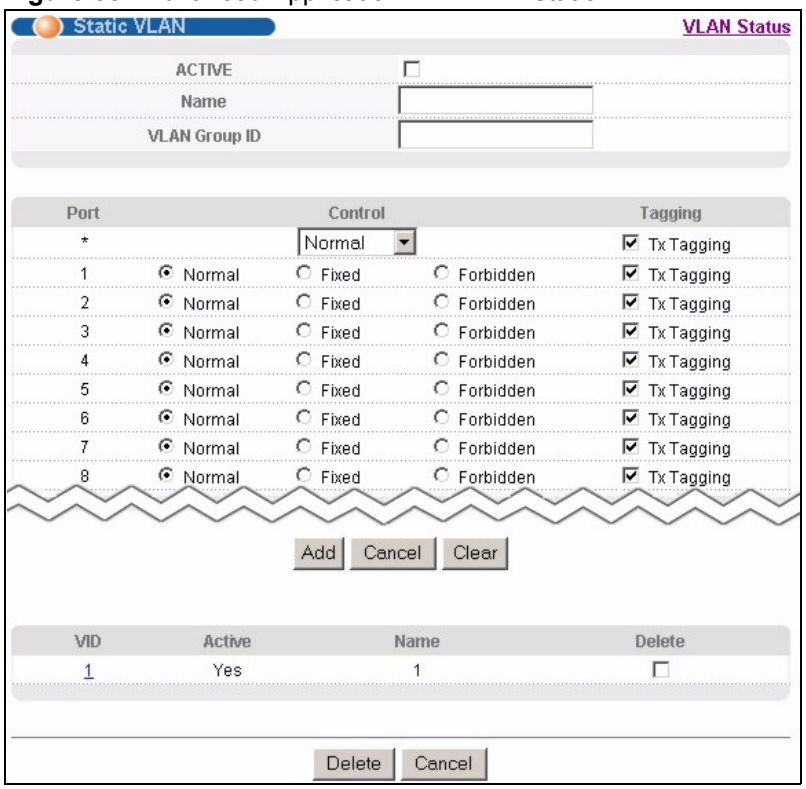
Table 16 Advanced Application > VLAN > VLAN Detail

LABEL	DESCRIPTION
VLAN Status	Click this to go to the **VLAN Status** screen.
VID	This is the VLAN identification number that was configured in the **Static VLAN** screen.
Port Number	This column displays the ports that are participating in a VLAN. A tagged port is marked as **T**, an untagged port is marked as **U** and ports not participating in a VLAN are marked as "**–**".
Elapsed Time	This field shows how long it has been since a normal VLAN was registered or a static VLAN was set up.
Status	This field shows how this VLAN was added to the Switch; **dynamic** - using GVRP, **static** - added as a permanent entry or **other** - added in another way such as via Multicast VLAN Registration (MVR).

8.5.3 Configure a Static VLAN

Use this screen to configure and view 802.1Q VLAN parameters for the Switch. See Section 8.1 on page 87 for more information on static VLAN. To configure a static VLAN, click **Static VLAN** in the **VLAN Status** screen to display the screen as shown next.

Figure 38 Advanced Application > VLAN > Static VLAN



The following table describes the related labels in this screen.

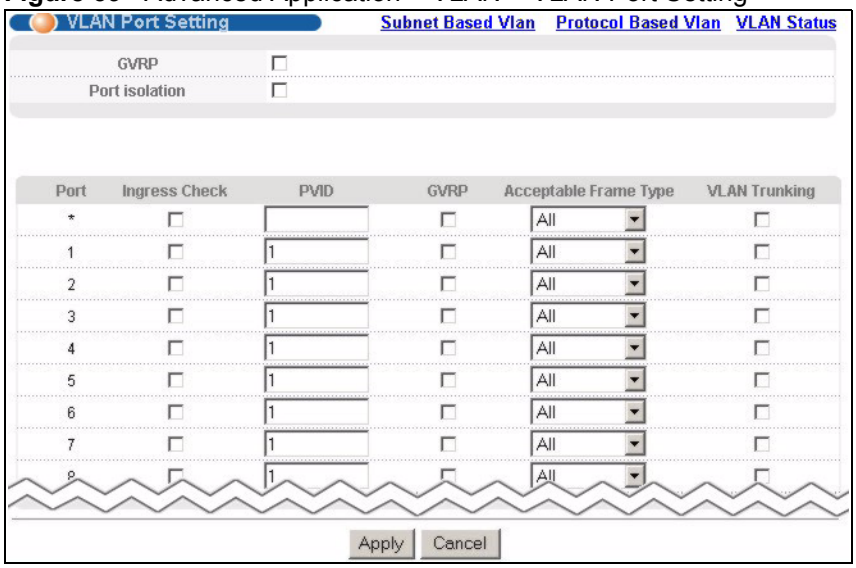
Table 17 Advanced Application > VLAN > Static VLAN

LABEL	DESCRIPTION
ACTIVE	Select this check box to activate the VLAN settings.
Name	Enter a descriptive name for the VLAN group for identification purposes. This name consists of up to 64 printable characters; spaces are allowed.
VLAN Group ID	Enter the VLAN ID for this static entry; the valid range is between 1 and 4094.
Port	The port number identifies the port you are configuring.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Control	Select **Normal** for the port to dynamically join this VLAN group using GVRP. This is the default selection. Select **Fixed** for the port to be a permanent member of this VLAN group. Select **Forbidden** if you want to prohibit the port from joining this VLAN group.
Tagging	Select **TX Tagging** if you want the port to tag all outgoing frames transmitted with this VLAN Group ID.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clear	Click **Clear** to start configuring the screen again.
VID	This field displays the ID number of the VLAN group. Click the number to edit the VLAN settings.
Active	This field indicates whether the VLAN settings are enabled (**Yes**) or disabled (**No**).
Name	This field displays the descriptive name for this VLAN group.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

8.5.4 Configure VLAN Port Settings

Use the VLAN Port Setting screen to configure the static VLAN (IEEE 802.1Q) settings on a port. See Section 8.1 on page 87 for more information on static VLAN. Click the **VLAN Port Setting** link in the **VLAN Status** screen.

Figure 39 Advanced Application > VLAN > VLAN Port Setting



The following table describes the labels in this screen.

Table 18 Advanced Application > VLAN > VLAN Port Setting

LABEL	DESCRIPTION
GVRP	GVRP (GARP VLAN Registration Protocol) is a registration protocol that defines a way for switches to register necessary VLAN members on ports across the network. Select this check box to permit VLAN groups beyond the local Switch.
Port Isolation	**Port Isolation** allows each port to communicate only with the CPU management port and the Gigabit uplink ports but not communicate with each other. This option is the most limiting but also the most secure.
Port	This field displays the port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Ingress Check	If this check box is selected for a port, the Switch discards incoming frames for VLANs that do not include this port in its member set. Clear this check box to disable ingress filtering.
PVID	Enter a number between 1and 4094 as the port VLAN ID.
GVRP	Select this check box to allow GVRP on this port.
Acceptable Frame Type	Specify the type of frames allowed on a port. Choices are **All**, **Tag Only** and **Untag Only**. Select **All** from the drop-down list box to accept all untagged or tagged frames on this port. This is the default setting. Select **Tag Only** to accept only tagged frames on this port. All untagged frames will be dropped. Select **Untag Only** to accept only untagged frames on this port. All tagged frames will be dropped.

Table 18 Advanced Application > VLAN > VLAN Port Setting (continued)

LABEL	DESCRIPTION
VLAN Trunking	Enable **VLAN Trunking** on ports connected to other switches or routers (but not ports directly connected to end users) to allow frames belonging to unknown VLAN groups to pass through the Switch.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

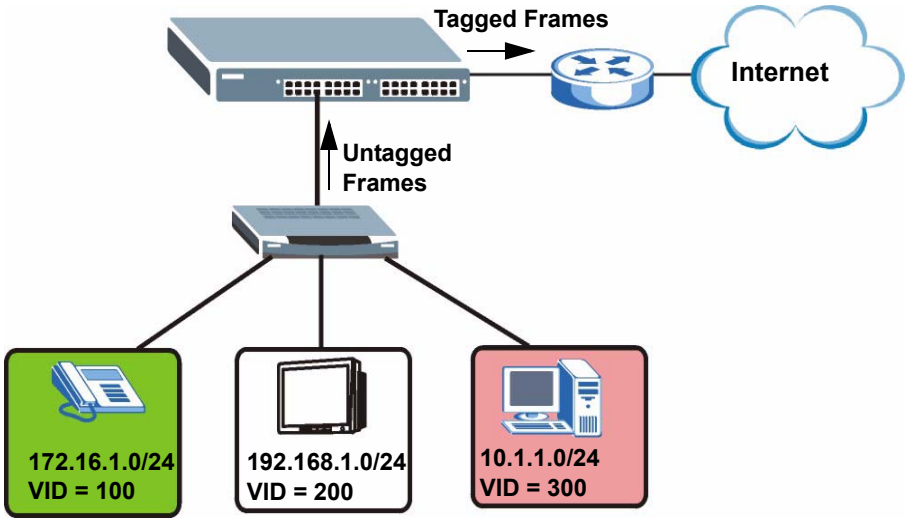
8.6 Subnet Based VLANs

Subnet based VLANs allow you to group traffic into logical VLANs based on the source IP subnet you specify. When a frame is received on a port, the Switch checks if a tag is added already and the IP subnet it came from. The untagged packets from the same IP subnet are then placed in the same subnet based VLAN. One advantage of using subnet based VLANs is that priority can be assigned to traffic from the same IP subnet.

For example, an ISP (Internet Services Provider) may divide different types of services it provides to customers into different IP subnets. Traffic for voice services is designated for IP subnet 172.16.1.0/24, video for 192.168.1.0/24 and data for 10.1.1.0/24. The Switch can then be configured to group incoming traffic based on the source IP subnet of incoming frames.

You configure a subnet based VLAN with priority 6 and VID of 100 for traffic received from IP subnet 172.16.1.0/24 (voice services). You also have a subnet based VLAN with priority 5 and VID of 200 for traffic received from IP subnet 192.168.1.0/24 (video services). Lastly, you configure VLAN with priority 3 and VID of 300 for traffic received from IP subnet 10.1.1.0/24 (data services). All untagged incoming frames will be classified based on their source IP subnet and prioritized accordingly. That is video services receive the highest priority and data the lowest.

Figure 40 Subnet Based VLAN Application Example

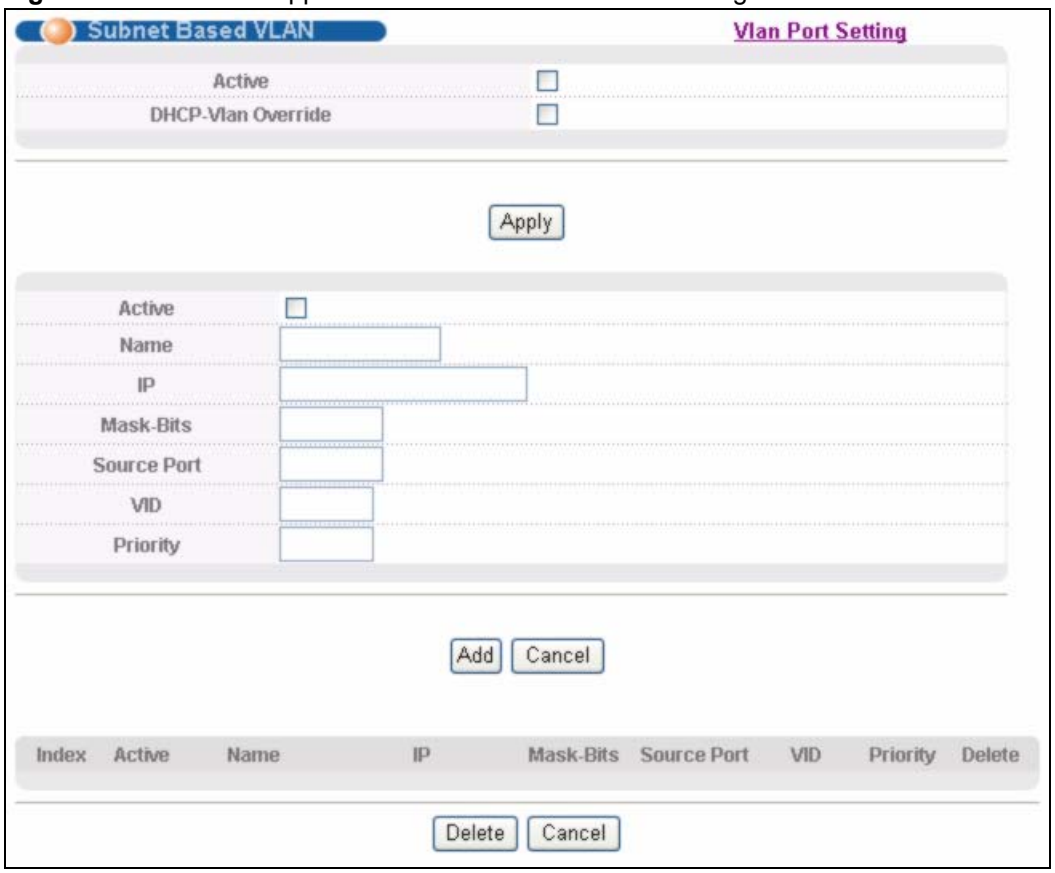


8.7 Configuring Subnet Based VLAN

Click **Subnet Based VLAN** in the **VLAN Port Setting** screen to display the configuration screen as shown.

Subnet based VLAN applies to un-tagged packets and is applicable only when you use IEEE 802.1Q tagged VLAN.

Figure 41 Advanced Application > VLAN > VLAN Port Setting > Subnet Based VLAN



The following table describes the labels in this screen.

Table 19 Advanced Application > VLAN > VLAN Port Setting > Subnet Based VLAN Setup

LABEL	DESCRIPTION
Active	Check this box to activate this subnet based VLANs on the Switch.
DHCP-Vlan Override	When DHCP snooping is enabled DHCP clients can renew their IP address through the DHCP VLAN or via another DHCP server on the subnet based VLAN. Select this to force the DHCP clients in this IP subnet to obtain their IP addresses through the DHCP VLAN.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.

Table 19 Advanced Application > VLAN > VLAN Port Setting > Subnet Based VLAN Setup

LABEL	DESCRIPTION
Active	Check this box to activate the IP subnet VLAN you are creating or editing.
Name	Enter up to 32 alpha numeric characters to identify this subnet based VLAN.
IP	Enter the IP address of the subnet for which you want to configure this subnet based VLAN.
Mask-Bits	Enter the bit number of the subnet mask. To find the bit number, convert the subnet mask to binary format and add all the 1's together. Take "255.255.255.0" for example. 255 converts to eight 1s in binary. There are three 255s, so add three eights together and you get the bit number (24).
Source Port	Enter the port to which this subnet based VLAN is bound.
VID	Enter the ID of a VLAN with which the untagged frames from the IP subnet specified in this subnet based VLAN are tagged. This must be an existing VLAN which you defined in the **Advanced Applications**, **VLAN** screens.
Priority	Select the priority level that the Switch assigns to frames belonging to this VLAN.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Index	This is the index number identifying this subnet based VLAN. Click on any of these numbers to edit an existing subnet based VLAN.
Active	This field shows whether the subnet based VLAN is active or not.
Name	This field shows the name the subnet based VLAN.
IP	This field shows the IP address of the subnet for this subnet based VLAN.
Mask-Bits	This field shows the subnet mask in bit number format for this subnet based VLAN.
Source Port	This field shows the port to which this subnet based VLAN is bound.
VID	This field shows the VLAN ID of the frames which belong to this subnet based VLAN.
Priority	This field shows the priority which is assigned to frames belonging to this subnet based VLAN.
Delete	Click this to delete the subnet based VLANs which you marked for deletion.
Cancel	Click **Cancel** to begin configuring this screen afresh.

8.8 Protocol Based VLANs

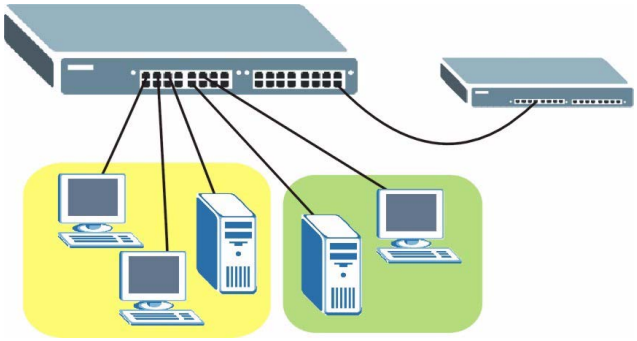
Protocol based VLANs allow you to group traffic into logical VLANs based on the protocol you specify. When an upstream frame is received on a port (configured for a protocol based VLAN), the Switch checks if a tag is added already and its protocol. The untagged packets of the same protocol are then placed in the same protocol based VLAN. One advantage of using protocol based VLANs is that priority can be assigned to traffic of the same protocol.



Protocol based VLAN applies to un-tagged packets and is applicable only when you use IEEE 802.1Q tagged VLAN.

For example, port 1, 2, 3 and 4 belong to static VLAN 100, and port 4, 5, 6, 7 belong to static VLAN 120. You configure a protocol based VLAN A with priority 3 for ARP traffic received on port 1, 2 and 3. You also have a protocol based VLAN B with priority 2 for Apple Talk traffic received on port 6 and 7. All upstream ARP traffic from port 1, 2 and 3 will be grouped together, and all upstream Apple Talk traffic from port 6 and 7 will be in another group and have higher priority than ARP traffic, when they go through the uplink port to a backbone switch C.

Figure 42 Protocol Based VLAN Application Example

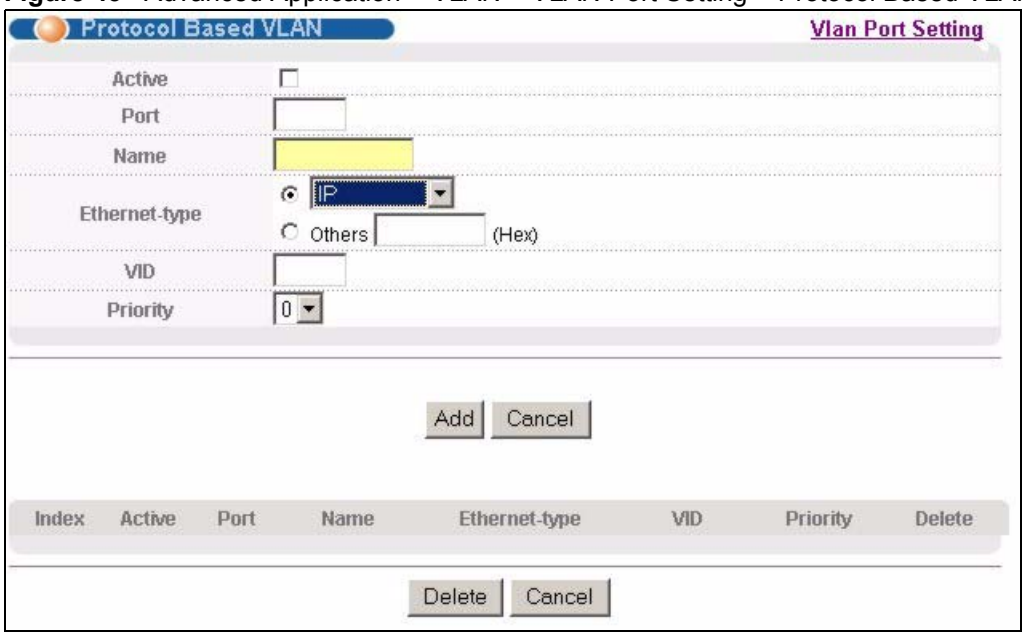


8.9 Configuring Protocol Based VLAN

Click **Protocol Based VLAN** in the **VLAN Port Setting** screen to display the configuration screen as shown.

Protocol-based VLAN applies to un-tagged packets and is applicable only when you use IEEE 802.1Q tagged VLAN.

Figure 43 Advanced Application > VLAN > VLAN Port Setting > Protocol Based VLAN



The following table describes the labels in this screen.

Table 20 Advanced Application > VLAN > VLAN Port Setting > Protocol Based VLAN Setup

LABEL	DESCRIPTION
Active	Check this box to activate this protocol based VLAN.
Port	Type a port to be included in this protocol based VLAN. This port must belong to a static VLAN in order to participate in a protocol based VLAN. See Chapter 8 on page 87 for more details on setting up VLANs.
Name	Enter up to 32 alpha numeric characters to identify this protocol based VLAN.
Ethernet-type	Use the drop down list box to select a predefined protocol to be included in this protocol based VLAN or select **Others** and type the protocol number in hexadecimal notation. For example the IP protocol in hexadecimal notation is 0800, and Novell IPX protocol is 8137. Note: Protocols in the hexadecimal number range of 0x0000 to 0x05ff are not allowed to be used for protocol based VLANs.
VID	Enter the ID of a VLAN to which the port belongs. This must be an existing VLAN which you defined in the **Advanced Applications**, **VLAN** screens.
Priority	Select the priority level that the Switch will assign to frames belonging to this VLAN.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Index	This is the index number identifying this protocol based VLAN. Click on any of these numbers to edit an existing protocol based VLAN.
Active	This field shows whether the protocol based VLAN is active or not.
Port	This field shows which port belongs to this protocol based VLAN.
Name	This field shows the name the protocol based VLAN.
Ethernet Type	This field shows which Ethernet protocol is part of this protocol based VLAN.

Table 20 Advanced Application > VLAN > VLAN Port Setting > Protocol Based VLAN Setup

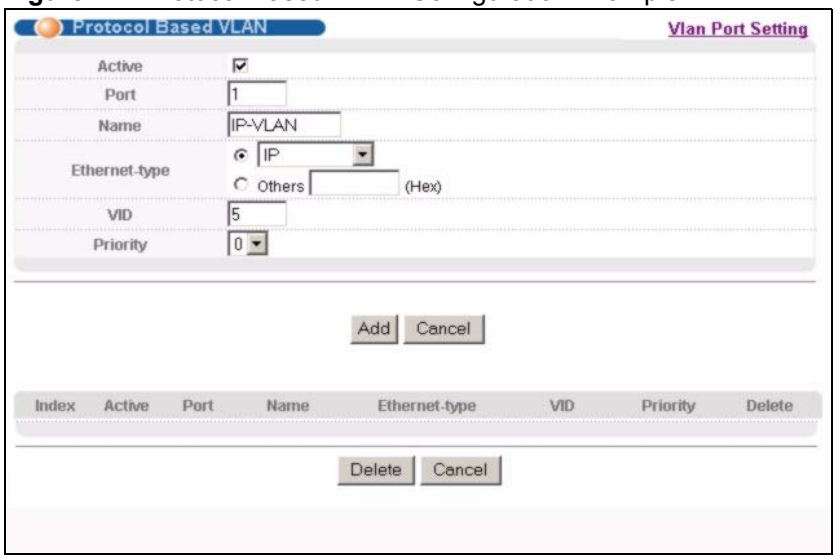
LABEL	DESCRIPTION
VID	This field shows the VLAN ID of the port.
Priority	This field shows the priority which is assigned to frames belonging to this protocol based VLAN.
Delete	Click this to delete the protocol based VLANs which you marked for deletion.
Cancel	Click **Cancel** to begin configuring this screen afresh.

8.10 Create an IP-based VLAN Example

This example shows you how to create an IP VLAN which includes ports 1, 4 and 8. Follow these steps:

1. Activate this protocol based VLAN.
2. Type the port number you want to include in this protocol based VLAN. Type **1**.
3. Give this protocol-based VLAN a descriptive name. Type **IP-VLAN**.
4. Select the protocol. Leave the default value **IP**.
5. Type the VLAN ID of an existing VLAN. In our example we already created a static VLAN with an ID of 5. Type **5**.
6. Leave the priority set to **0** and click **Add**.

Figure 44 Protocol Based VLAN Configuration Example



To add more ports to this protocol based VLAN.

1. Click the index number of the protocol based VLAN entry. Click **1**
2. Change the value in the **Port** field to the next port you want to add.
3. Click **Add**.

8.11 Port-based VLAN Setup

Port-based VLANs are VLANs where the packet forwarding decision is based on the destination MAC address and its associated port.

Port-based VLANs require allowed outgoing ports to be defined for each port. Therefore, if you wish to allow two subscriber ports to talk to each other, for example, between conference rooms in a hotel, you must define the egress (an egress port is an outgoing port, that is, a port through which a data packet leaves) for both ports.

Port-based VLANs are specific only to the Switch on which they were created.



When you activate port-based VLAN, the Switch uses a default VLAN ID of 1. You cannot change it.



In screens (such as **IP Setup** and **Filtering**) that require a VID, you must enter 1 as the VID.

The port-based VLAN setup screen is shown next. The **CPU** management port forms a VLAN with all Ethernet ports.

8.11.1 Configure a Port-based VLAN

Select **Port Based** as the **VLAN Type** in the **Switch Setup** screen and then click **VLAN** from the navigation panel to display the next screen.

Figure 45 Advanced Application > VLAN: Port Based VLAN Setup (All Connected)

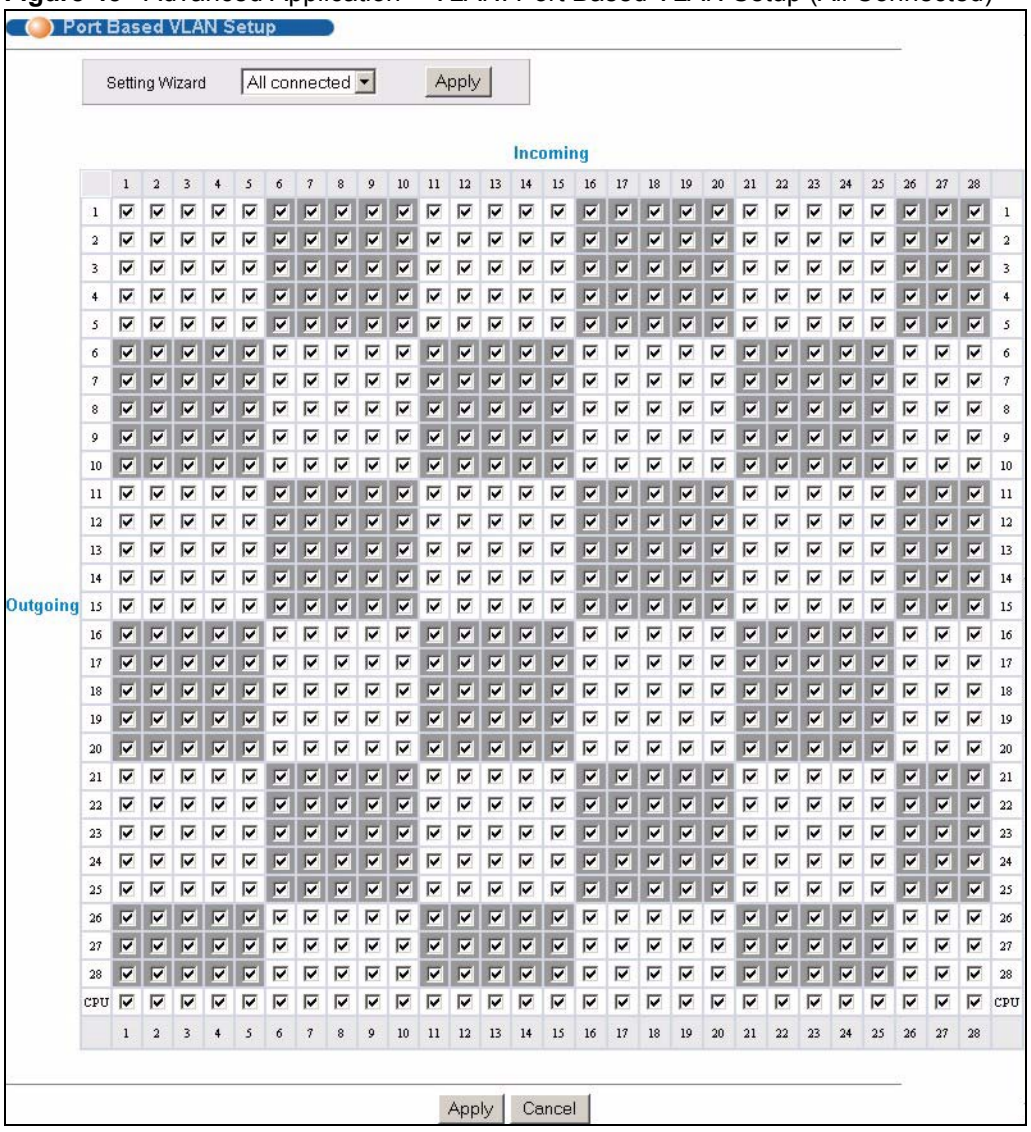
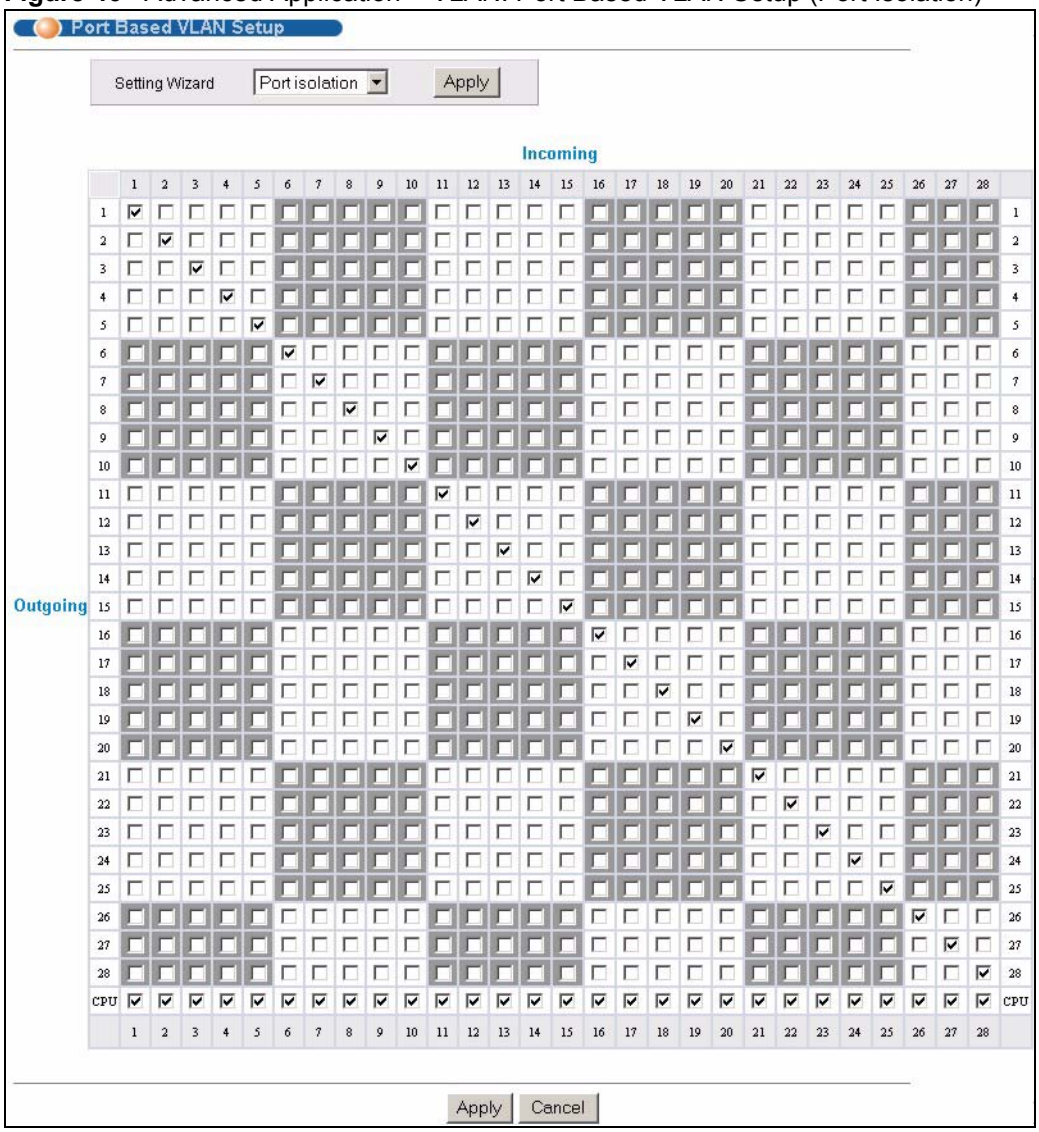


Figure 46 Advanced Application > VLAN: Port Based VLAN Setup (Port Isolation)



The following table describes the labels in this screen.

Table 21 Advanced Application > VLAN: Port Based VLAN Setup

LABEL	DESCRIPTION
Setting Wizard	Choose **All connected** or **Port isolation**. **All connected** means all ports can communicate with each other, that is, there are no virtual LANs. All incoming and outgoing ports are selected. This option is the most flexible but also the least secure. **Port isolation** means that each port can only communicate with the CPU management port and cannot communicate with each other. All incoming ports are selected while only the CPU outgoing port is selected. This option is the most limiting but also the most secure. After you make your selection, click **Apply** (top right of screen) to display the screens as mentioned above. You can still customize these settings by adding/deleting incoming or outgoing ports, but you must also click **Apply** at the bottom of the screen.
Incoming	These are the ingress ports; an ingress port is an incoming port, that is, a port through which a data packet enters. If you wish to allow two subscriber ports to talk to each other, you must define the ingress port for both ports. The numbers in the top row denote the incoming port for the corresponding port listed on the left (its outgoing port). **CPU** refers to the Switch management port. By default it forms a VLAN with all Ethernet ports. If it does not form a VLAN with a particular port then the Switch cannot be managed from that port.
Outgoing	These are the egress ports; an egress port is an outgoing port, that is, a port through which a data packet leaves. If you wish to allow two subscriber ports to talk to each other, you must define the egress port for both ports. **CPU** refers to the Switch management port. By default it forms a VLAN with all Ethernet ports. If it does not form a VLAN with a particular port then the Switch cannot be managed from that port.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

9

Static MAC Forward Setup

Use these screens to configure static MAC address forwarding.

9.1 Overview

This chapter discusses how to configure forwarding rules based on MAC addresses of devices on your network.

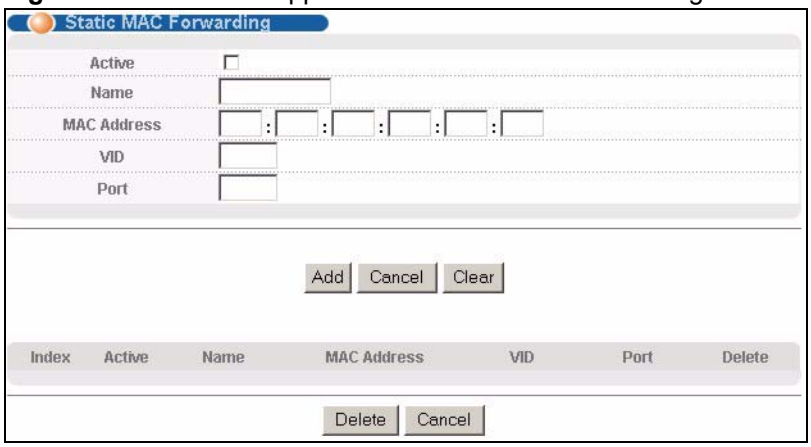
9.2 Configuring Static MAC Forwarding

A static MAC address is an address that has been manually entered in the MAC address table. Static MAC addresses do not age out. When you set up static MAC address rules, you are setting static MAC addresses for a port. This may reduce the need for broadcasting.

Static MAC address forwarding together with port security allow only computers in the MAC address table on a port to access the Switch. See Chapter 17 on page 147 for more information on port security.

Click **Advanced Applications > Static MAC Forwarding** in the navigation panel to display the configuration screen as shown.

Figure 47 Advanced Application > Static MAC Forwarding



The following table describes the labels in this screen.

Table 22 Advanced Application > Static MAC Forwarding

LABEL	DESCRIPTION
Active	Select this check box to activate your rule. You may temporarily deactivate a rule without deleting it by clearing this check box.
Name	Enter a descriptive name for identification purposes for this static MAC address forwarding rule.
MAC Address	Enter the MAC address in valid MAC address format, that is, six hexadecimal character pairs. Note: Static MAC addresses do not age out.
VID	Enter the VLAN identification number.
Port	Enter the port where the MAC address entered in the previous field will be automatically forwarded.
Add	Click **Add** to save your rule to the Switch's run-time memory. The Switch loses this rule if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clear	Click **Clear** to begin configuring this screen afresh.
Index	Click an index number to modify a static MAC address rule for a port.
Active	This field displays whether this static MAC address forwarding rule is active (**Yes**) or not (**No**). You may temporarily deactivate a rule without deleting it.
Name	This field displays the descriptive name for identification purposes for this static MAC address-forwarding rule.
MAC Address	This field displays the MAC address that will be forwarded and the VLAN identification number to which the MAC address belongs.
VID	This field displays the ID number of the VLAN group.
Port	This field displays the port where the MAC address shown in the next field will be forwarded.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

10

Filtering

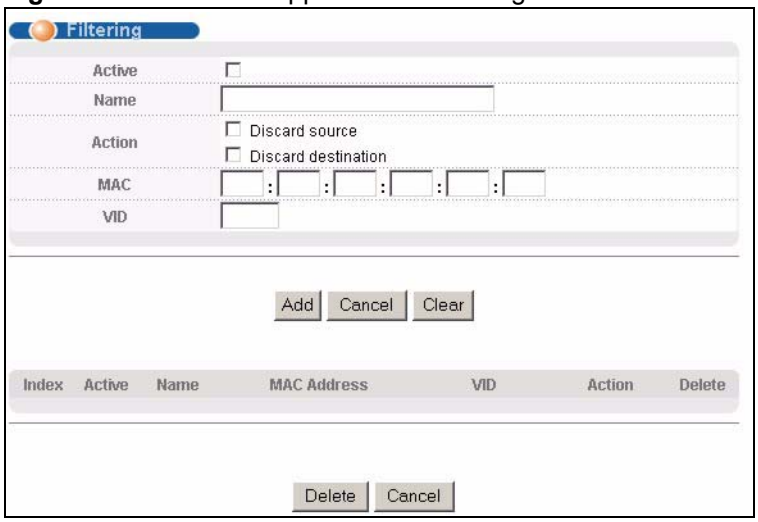
This chapter discusses MAC address port filtering.

10.1 Configure a Filtering Rule

Filtering means sifting traffic going through the Switch based on the source and/or destination MAC addresses and VLAN group (ID).

Click **Advanced Application** > **Filtering** in the navigation panel to display the screen as shown next.

Figure 48 Advanced Application > Filtering



The following table describes the related labels in this screen.

Table 23 Advanced Application > FIltering

LABEL	DESCRIPTION
Active	Make sure to select this check box to activate your rule. You may temporarily deactivate a rule without deleting it by deselecting this check box.
Name	Type a descriptive name (up to 32 printable ASCII characters) for this rule. This is for identification only.

Table 23 Advanced Application > FIltering (continued)

LABEL	DESCRIPTION
Action	Select **Discard source** to drop frame from the source MAC address (specified in the **MAC** field). The Switch can still send frames to the MAC address. Select **Discard destination** to drop frames to the destination MAC address (specified in the **MAC** address). The Switch can still receive frames originating from the MAC address. Select **Discard source** and **Discard destination** to block traffic to/from the MAC address specified in the **MAC** field.
MAC	Type a MAC address in valid MAC address format, that is, six hexadecimal character pairs.
VID	Type the VLAN group identification number.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clear	Click **Clear** to clear the fields to the factory defaults.
Index	This field displays the index number of the rule. Click an index number to change the settings.
Active	This field displays **Yes** when the rule is activated and **No** when is it deactivated.
Name	This field displays the descriptive name for this rule. This is for identification purpose only.
MAC Address	This field displays the source/destination MAC address with the VLAN identification number to which the MAC address belongs.
VID	This field displays the VLAN group identification number.
Delete	Check the rule(s) that you want to remove in the **Delete** column and then click the **Delete** button.
Cancel	Click **Cancel** to clear the selected checkbox(es) in the **Delete** column.

11

Spanning Tree Protocol

The Switch supports Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP) as defined in the following standards.

- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1w Rapid Spanning Tree Protocol
- IEEE 802.1s Multiple Spanning Tree Protocol

The Switch also allows you to set up multiple STP configurations (or trees). Ports can then be assigned to the trees.

11.1 STP/RSTP Overview

(R)STP detects and breaks network loops and provides backup links between switches, bridges or routers. It allows a Switch to interact with other (R)STP -compliant switches in your network to ensure that only one path exists between any two stations on the network.

The Switch uses IEEE 802.1w RSTP (Rapid Spanning Tree Protocol) that allows faster convergence of the spanning tree than STP (while also being backwards compatible with STP-only aware bridges). In RSTP, topology change information is directly propagated throughout the network from the device that generates the topology change. In STP, a longer delay is required as the device that causes a topology change first notifies the root bridge that then notifies the network. Both RSTP and STP flush unwanted learned addresses from the filtering database. In RSTP, the port states are Discarding, Learning, and Forwarding.



In this user's guide, "STP" refers to both STP and RSTP.

11.1.1 STP Terminology

The root bridge is the base of the spanning tree.

Path cost is the cost of transmitting a frame onto a LAN through that port. The recommended cost is assigned according to the speed of the link to which a port is attached. The slower the media, the higher the cost.

Table 24 STP Path Costs

	LINK SPEED	RECOMMENDED VALUE	RECOMMENDED RANGE	ALLOWED RANGE
Path Cost	4Mbps	250	100 to 1000	1 to 65535
Path Cost	10Mbps	100	50 to 600	1 to 65535
Path Cost	16Mbps	62	40 to 400	1 to 65535
Path Cost	100Mbps	19	10 to 60	1 to 65535
Path Cost	1Gbps	4	3 to 10	1 to 65535
Path Cost	10Gbps	2	1 to 5	1 to 65535

On each bridge, the root port is the port through which this bridge communicates with the root. It is the port on this Switch with the lowest path cost to the root (the root path cost). If there is no root port, then this Switch has been accepted as the root bridge of the spanning tree network.

For each LAN segment, a designated bridge is selected. This bridge has the lowest cost to the root among the bridges connected to the LAN.

11.1.2 How STP Works

After a bridge determines the lowest cost-spanning tree with STP, it enables the root port and the ports that are the designated ports for connected LANs, and disables all other ports that participate in STP. Network packets are therefore only forwarded between enabled ports, eliminating any possible network loops.

STP-aware switches exchange Bridge Protocol Data Units (BPDUs) periodically. When the bridged LAN topology changes, a new spanning tree is constructed.

Once a stable network topology has been established, all bridges listen for Hello BPDUs (Bridge Protocol Data Units) transmitted from the root bridge. If a bridge does not get a Hello BPDU after a predefined interval (Max Age), the bridge assumes that the link to the root bridge is down. This bridge then initiates negotiations with other bridges to reconfigure the network to re-establish a valid network topology.

11.1.3 STP Port States

STP assigns five port states to eliminate packet looping. A bridge port is not allowed to go directly from blocking state to forwarding state so as to eliminate transient loops.

Table 25 STP Port States

PORT STATE	DESCRIPTION
Disabled	STP is disabled (default).
Blocking	Only configuration and management BPDUs are received and processed.
Listening	All BPDUs are received and processed. Note: The listening state does not exist in RSTP.
Learning	All BPDUs are received and processed. Information frames are submitted to the learning process but not forwarded.
Forwarding	All BPDUs are received and processed. All information frames are received and forwarded.

11.1.4 Multiple RSTP

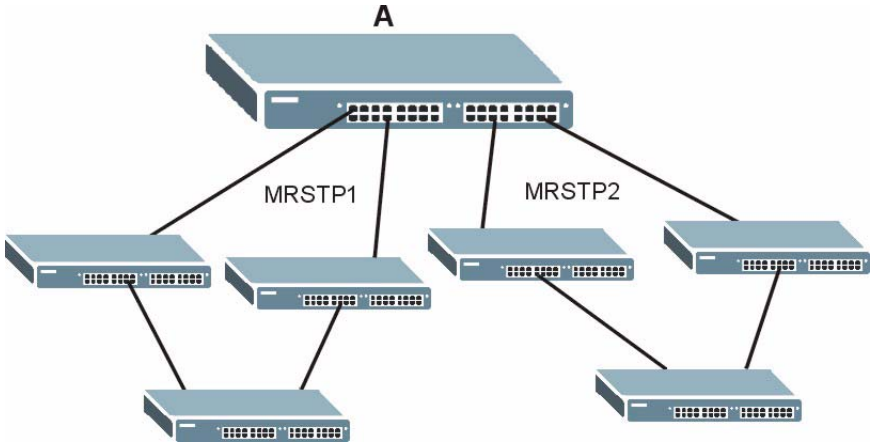
MRSTP (Multiple RSTP) is ZyXEL's proprietary feature that is compatible with RSTP and STP. With MRSTP, you can have more than one spanning tree on your Switch and assign port(s) to each tree. Each spanning tree operates independently with its own bridge information.

In the following example, there are two RSTP instances (**MRSTP 1** and **MRSTP2**) on switch **A**.

To set up MRSTP, activate MRSTP on the Switch and specify which port(s) belong to which spanning tree.

Each port can belong to one STP tree only.

Figure 49 MRSTP Network Example



11.1.5 Multiple STP

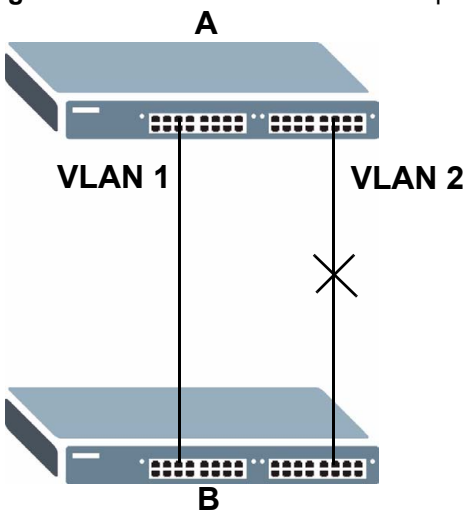
Multiple Spanning Tree Protocol (IEEE 802.1s) is backward compatible with STP/RSTP and addresses the limitations of existing spanning tree protocols (STP and RSTP) in networks to include the following features:

- One Common and Internal Spanning Tree (CIST) that represents the entire network's connectivity.
- Grouping of multiple bridges (or switching devices) into regions that appear as one single bridge on the network.
- A VLAN can be mapped to a specific Multiple Spanning Tree Instance (MSTI). MSTI allows multiple VLANs to use the same spanning tree.
- Load-balancing is possible as traffic from different VLANs can use distinct paths in a region.

11.1.5.1 MSTP Network Example

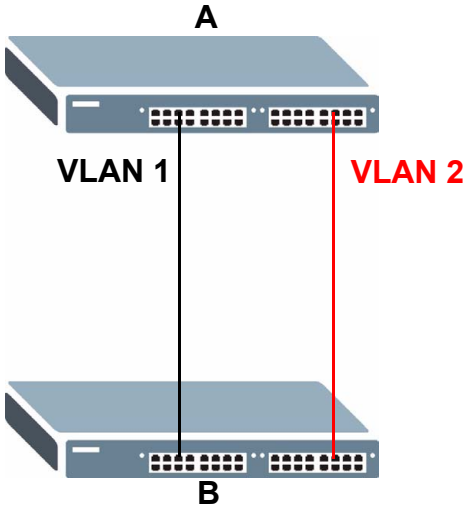
The following figure shows a network example where two VLANs are configured on the two switches. If the switches are using STP or RSTP, the link for VLAN 2 will be blocked as STP and RSTP allow only one link in the network and block the redundant link.

Figure 50 STP/RSTP Network Example



With MSTP, VLANs 1 and 2 are mapped to different spanning trees in the network. Thus traffic from the two VLANs travel on different paths. The following figure shows the network example using MSTP.

Figure 51 MSTP Network Example



11.1.5.2 MST Region

An MST region is a logical grouping of multiple network devices that appears as a single device to the rest of the network. Each MSTP-enabled device can only belong to one MST region. When BPDUs enter an MST region, external path cost (of paths outside this region) is increased by one. Internal path cost (of paths within this region) is increased by one when BPDUs traverse the region.

Devices that belong to the same MST region are configured to have the same MSTP configuration identification settings. These include the following parameters:

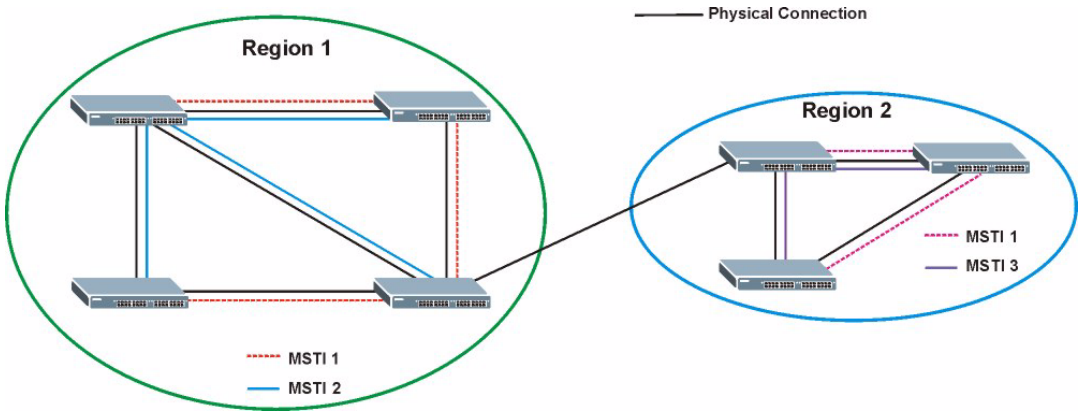
- Name of the MST region
- Revision level as the unique number for the MST region
- VLAN-to-MST Instance mapping

11.1.5.3 MST Instance

An MST Instance (MSTI) is a spanning tree instance. VLANs can be configured to run on a specific MSTI. Each created MSTI is identified by a unique number (known as an MST ID) known internally to a region. Thus an MSTI does not span across MST regions.

The following figure shows an example where there are two MST regions. Regions 1 and 2 have 2 spanning tree instances.

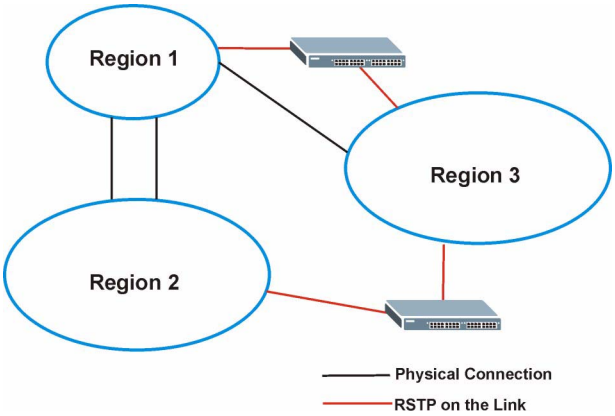
Figure 52 MSTIs in Different Regions



11.1.5.4 Common and Internal Spanning Tree (CIST)

A CIST represents the connectivity of the entire network and it is equivalent to a spanning tree in an STP/RSTP. The CIST is the default MST instance (MSTID 0). Any VLANs that are not members of an MST instance are members of the CIST. In an MSTP-enabled network, there is only one CIST that runs between MST regions and single spanning tree devices. A network may contain multiple MST regions and other network segments running RSTP.

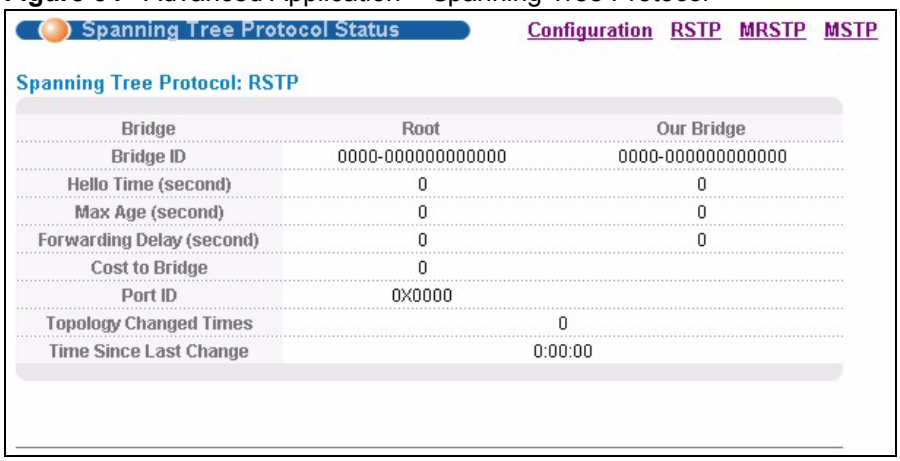
Figure 53 MSTP and Legacy RSTP Network Example



11.2 Spanning Tree Protocol Status Screen

The Spanning Tree Protocol status screen changes depending on what standard you choose to implement on your network. Click **Advanced Application** > **Spanning Tree Protocol** to see the screen as shown.

Figure 54 Advanced Application > Spanning Tree Protocol



This screen differs depending on which STP mode (RSTP, MRSTP or MSTP) you configure on the Switch. This screen is described in detail in the section that follows the configuration section for each STP mode. Click **Configuration** to activate one of the STP standards on the Switch.

11.3 Spanning Tree Configuration

Use the **Spanning Tree Configuration** screen to activate one of the STP modes on the Switch. Click **Configuration** in the **Advanced Application** > **Spanning Tree Protocol**.

Figure 55 Advanced Application > Spanning Tree Protocol > Configuration



The following table describes the labels in this screen.

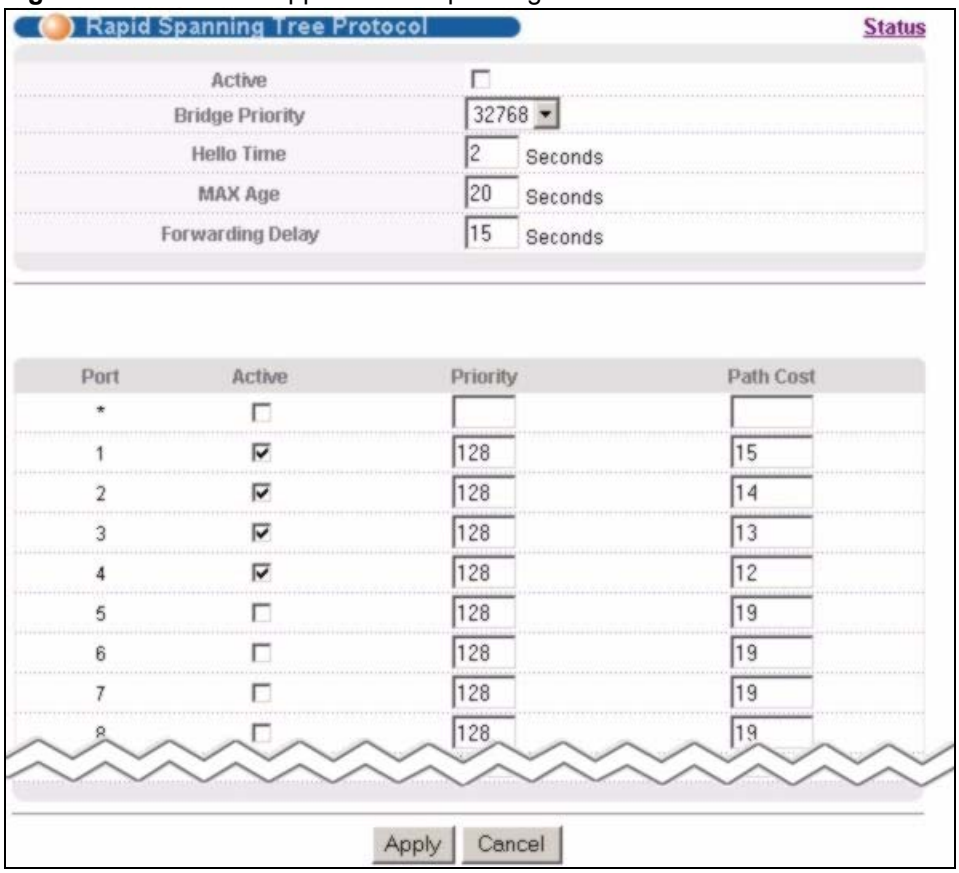
Table 26 Advanced Application > Spanning Tree Protocol > Configuration

LABEL	DESCRIPTION
Spanning Tree Mode	You can activate one of the STP modes on the Switch. Select **Rapid Spanning Tree**, **Multiple Rapid Spanning Tree** or **Multiple Spanning Tree**. See Section 11.1 on page 109 for background information on STP.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

11.4 Configure Rapid Spanning Tree Protocol

Use this screen to configure RSTP settings, see Section 11.1 on page 109 for more information on RSTP. Click **RSTP** in the **Advanced Application** > **Spanning Tree Protocol** screen.

Figure 56 Advanced Application > Spanning Tree Protocol > RSTP



The following table describes the labels in this screen.

Table 27 Advanced Application > Spanning Tree Protocol > RSTP

LABEL	DESCRIPTION
Status	Click **Status** to display the **RSTP Status** screen (see Figure 57 on page 118).
Active	Select this to activate RSTP. Clear this to disable RSTP. Note: You must also activate **Rapid Spanning Tree** in the **Advanced Application** > **Spanning Tree Protocol** > **Configuration** screen to enable RSTP on the Switch.
Bridge Priority	Bridge priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch. Select a value from the drop-down list box. The lower the numeric value you assign, the higher the priority for this bridge. Bridge Priority determines the root bridge, which in turn determines Hello Time, Max Age and Forwarding Delay.

Table 27 Advanced Application > Spanning Tree Protocol > RSTP (continued)

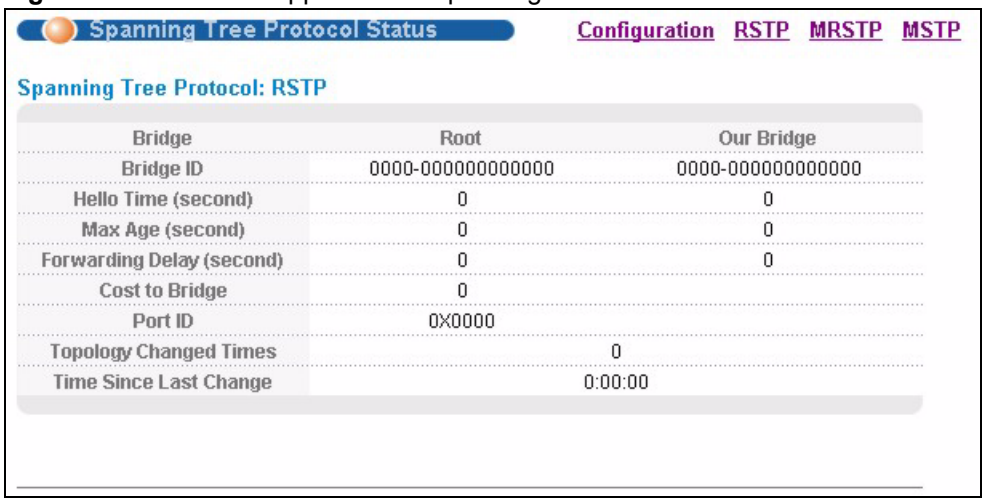
LABEL	DESCRIPTION
Hello Time	This is the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch. The allowed range is 1 to 10 seconds.
Max Age	This is the maximum time (in seconds) a switch can wait without receiving a BPDU before attempting to reconfigure. All switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that ages out STP information (provided in the last BPDU) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the switch ports attached to the network. The allowed range is 6 to 40 seconds.
Forwarding Delay	This is the maximum time (in seconds) a switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result. The allowed range is 4 to 30 seconds. As a general rule: Note: 2 * (Forward Delay - 1) >= Max Age >= 2 * (Hello Time + 1)
Port	This field displays the port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to activate RSTP on this port.
Priority	Configure the priority for each port here. Priority decides which port should be disabled when more than one port forms a loop in a switch. Ports with a higher priority numeric value are disabled first. The allowed range is between 0 and 255 and the default value is 128.
Path Cost	Path cost is the cost of transmitting a frame on to a LAN through that port. It is recommended to assign this value according to the speed of the bridge. The slower the media, the higher the cost - see Table 24 on page 110 for more information.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

11.5 Rapid Spanning Tree Protocol Status

Click **Advanced Application** > **Spanning Tree Protocol** in the navigation panel to display the status screen as shown next. See Section 11.1 on page 109 for more information on RSTP.

This screen is only available after you activate RSTP on the Switch.

Figure 57 Advanced Application > Spanning Tree Protocol > Status: RSTP



The following table describes the labels in this screen.

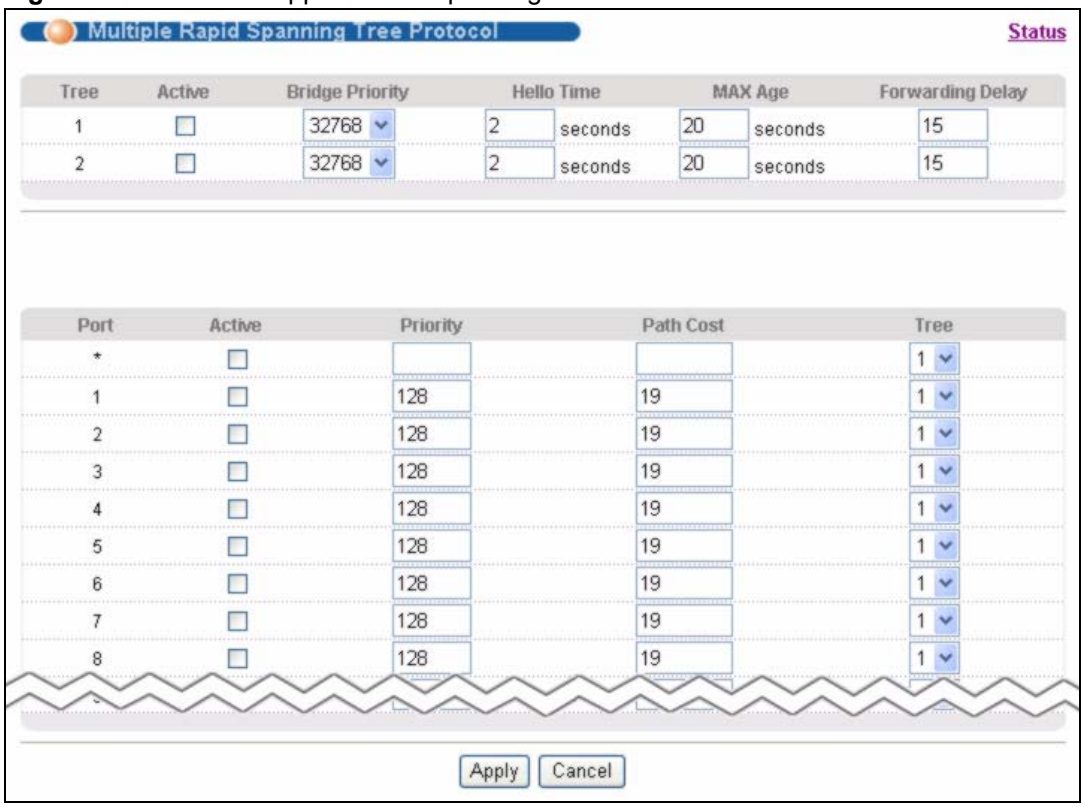
Table 28 Advanced Application > Spanning Tree Protocol > Status: RSTP

LABEL	DESCRIPTION
Configuration	Click **Configuration** to specify which STP mode you want to activate. Click **RSTP** to edit RSTP settings on the Switch.
Bridge	**Root** refers to the base of the spanning tree (the root bridge). **Our Bridge** is this Switch. This Switch may also be the root bridge.
Bridge ID	This is the unique identifier for this bridge, consisting of bridge priority plus MAC address. This ID is the same for **Root** and **Our Bridge** if the Switch is the root switch.
Hello Time (second)	This is the time interval (in seconds) at which the root switch transmits a configuration message. The root bridge determines Hello Time, Max Age and Forwarding Delay.
Max Age (second)	This is the maximum time (in seconds) a switch can wait without receiving a configuration message before attempting to reconfigure.
Forwarding Delay (second)	This is the time (in seconds) the root switch will wait before changing states (that is, listening to learning to forwarding). Note: The listening state does not exist in RSTP.
Cost to Bridge	This is the path cost from the root port on this Switch to the root switch.
Port ID	This is the priority and number of the port on the Switch through which this Switch must communicate with the root of the Spanning Tree.
Topology Changed Times	This is the number of times the spanning tree has been reconfigured.
Time Since Last Change	This is the time since the spanning tree was last reconfigured.

11.6 Configure Multiple Rapid Spanning Tree Protocol

To configure MRSTP, click **MRSTP** in the **Advanced Application** > **Spanning Tree Protocol** screen. See Section 11.1 on page 109 for more information on MRSTP.

Figure 58 Advanced Application > Spanning Tree Protocol > MRSTP



The following table describes the labels in this screen.

Table 29 Advanced Application > Spanning Tree Protocol > MRSTP

LABEL	DESCRIPTION
Status	Click **Status** to display the **MRSTP Status** screen (see Figure 57 on page 118).
Tree	This is a read only index number of the STP trees.
Active	Select this to activate an STP tree. Clear this to disable an STP tree. Note: You must also activate **Multiple Rapid Spanning Tree** in the **Advanced Application** > **Spanning Tree Protocol** > **Configuration** screen to enable MRSTP on the Switch.
Bridge Priority	Bridge priority is used in determining the root switch, root port and designated port. The switch with the highest priority (lowest numeric value) becomes the STP root switch. If all switches have the same priority, the switch with the lowest MAC address will then become the root switch. Select a value from the drop-down list box. The lower the numeric value you assign, the higher the priority for this bridge. Bridge Priority determines the root bridge, which in turn determines Hello Time, Max Age and Forwarding Delay.

Table 29 Advanced Application > Spanning Tree Protocol > MRSTP (continued)

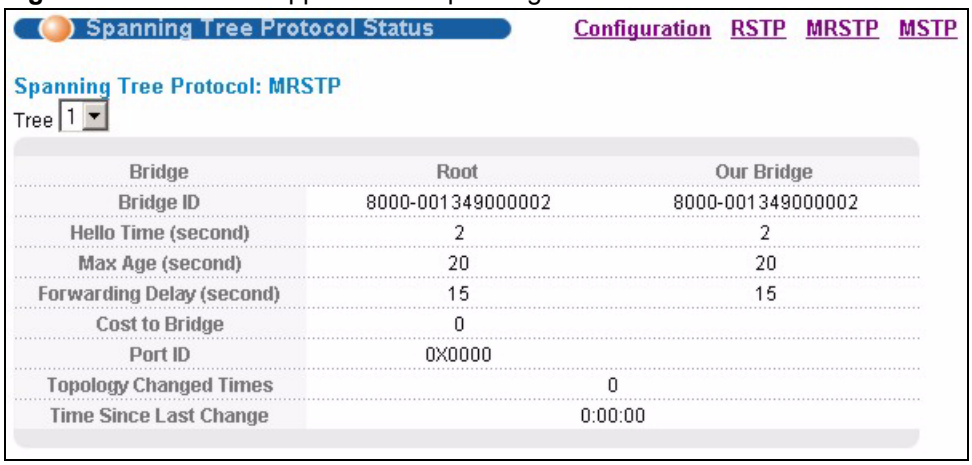
LABEL	DESCRIPTION
Hello Time	This is the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch. The allowed range is 1 to 10 seconds.
MAX Age	This is the maximum time (in seconds) a switch can wait without receiving a BPDU before attempting to reconfigure. All switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that ages out STP information (provided in the last BPDU) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the Switch ports attached to the network. The allowed range is 6 to 40 seconds.
Forwarding Delay	This is the maximum time (in seconds) a switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result. The allowed range is 4 to 30 seconds. As a general rule: Note: 2 * (Forward Delay - 1) >= Max Age >= 2 * (Hello Time + 1)
Port	This field displays the port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to activate STP on this port.
Priority	Configure the priority for each port here. Priority decides which port should be disabled when more than one port forms a loop in the Switch. Ports with a higher priority numeric value are disabled first. The allowed range is between 0 and 255 and the default value is 128.
Path Cost	Path cost is the cost of transmitting a frame on to a LAN through that port. It is recommended to assign this value according to the speed of the bridge. The slower the media, the higher the cost - see Table 24 on page 110 for more information.
Tree	Select which STP tree configuration this port should participate in.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

11.7 Multiple Rapid Spanning Tree Protocol Status

Click **Advanced Application** > **Spanning Tree Protocol** in the navigation panel to display the status screen as shown next. See Section 11.1 on page 109 for more information on MRSTP.

This screen is only available after you activate MRSTP on the Switch.

Figure 59 Advanced Application > Spanning Tree Protocol > Status: MRSTP



The following table describes the labels in this screen.

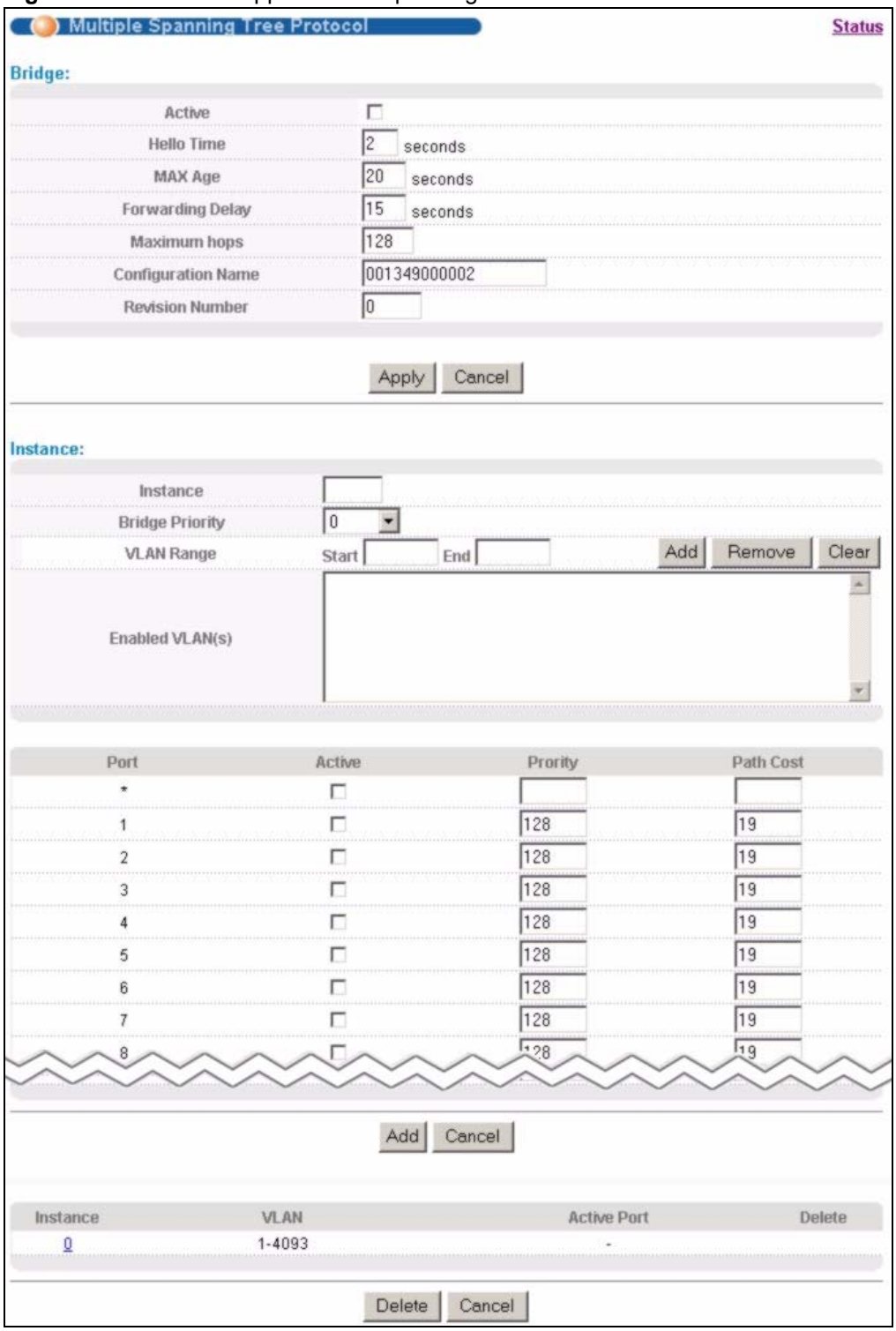
Table 30 Advanced Application > Spanning Tree Protocol > Status: MRSTP

LABEL	DESCRIPTION
Configuration	Click **Configuration** to specify which STP mode you want to activate. Click **MRSTP** to edit MRSTP settings on the Switch.
Tree	Select which STP tree configuration you want to view.
Bridge	**Root** refers to the base of the spanning tree (the root bridge). **Our Bridge** is this Switch. This Switch may also be the root bridge.
Bridge ID	This is the unique identifier for this bridge, consisting of bridge priority plus MAC address. This ID is the same for **Root** and **Our Bridge** if the Switch is the root switch.
Hello Time (second)	This is the time interval (in seconds) at which the root switch transmits a configuration message. The root bridge determines Hello Time, Max Age and Forwarding Delay.
Max Age (second)	This is the maximum time (in seconds) a switch can wait without receiving a configuration message before attempting to reconfigure.
Forwarding Delay (second)	This is the time (in seconds) the root switch will wait before changing states (that is, listening to learning to forwarding). Note: The listening state does not exist in RSTP.
Cost to Bridge	This is the path cost from the root port on this Switch to the root switch.
Port ID	This is the priority and number of the port on the Switch through which this Switch must communicate with the root of the Spanning Tree.
Topology Changed Times	This is the number of times the spanning tree has been reconfigured.
Time Since Last Change	This is the time since the spanning tree was last reconfigured.

11.8 Configure Multiple Spanning Tree Protocol

To configure MSTP, click **MSTP** in the **Advanced Application** > **Spanning Tree Protocol** screen. See Section 11.1.5 on page 112 for more information on MSTP.

Figure 60 Advanced Application > Spanning Tree Protocol > MSTP



The following table describes the labels in this screen.

Table 31 Advanced Application > Spanning Tree Protocol > MSTP

LABEL	DESCRIPTION
Status	Click **Status** to display the **MSTP Status** screen (see Figure 61 on page 125).
Active	Select this to activate MSTP on the Switch. Clear this to disable MSTP on the Switch. Note: You must also activate **Multiple Spanning Tree** in the **Advanced Application > Spanning Tree Protocol > Configuration** screen to enable MSTP on the Switch.
Hello Time	This is the time interval in seconds between BPDU (Bridge Protocol Data Units) configuration message generations by the root switch. The allowed range is 1 to 10 seconds.
MaxAge	This is the maximum time (in seconds) a switch can wait without receiving a BPDU before attempting to reconfigure. All switch ports (except for designated ports) should receive BPDUs at regular intervals. Any port that ages out STP information (provided in the last BPDU) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the Switch ports attached to the network. The allowed range is 6 to 40 seconds.
Forwarding Delay	This is the maximum time (in seconds) a switch will wait before changing states. This delay is required because every switch must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a blocking state; otherwise, temporary data loops might result. The allowed range is 4 to 30 seconds. As a general rule: Note: 2 * (Forward Delay - 1) >= Max Age >= 2 * (Hello Time + 1)
Maximum hops	Enter the number of hops (between 1 and 255) in an MSTP region before the BPDU is discarded and the port information is aged.
Configuration Name	Enter a descriptive name (up to 32 characters) of an MST region.
Revision Number	Enter a number to identify a region's configuration. Devices must have the same revision number to belong to the same region.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Instance	Use this section to configure MSTI (Multiple Spanning Tree Instance) settings.
Instance	Enter the number you want to use to identify this MST instance on the Switch. The Switch supports instance numbers 0-16.
Bridge Priority	Set the priority of the Switch for the specific spanning tree instance. The lower the number, the more likely the Switch will be chosen as the root bridge within the spanning tree instance. Enter priority values between 0 and 61440 in increments of 4096 (thus valid values are 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344 and 61440).

Table 31 Advanced Application > Spanning Tree Protocol > MSTP (continued)

LABEL	DESCRIPTION
VLAN Range	Enter the start of the VLAN ID range that you want to add or remove from the VLAN range edit area in the **Start** field. Enter the end of the VLAN ID range that you want to add or remove from the VLAN range edit area in the **End** field. Next click: • **Add** - to add this range of VLAN(s) to be mapped to the MST instance. • **Remove** - to remove this range of VLAN(s) from being mapped to the MST instance. • **Clear** - to remove all VLAN(s) from being mapped to this MST instance.
Enabled VLAN(s)	This field displays which VLAN(s) are mapped to this MST instance.
Port	This field displays the port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to add this port to the MST instance.
Priority	Configure the priority for each port here. Priority decides which port should be disabled when more than one port forms a loop in the Switch. Ports with a higher priority numeric value are disabled first. The allowed range is between 0 and 255 and the default value is 128.
Path Cost	Path cost is the cost of transmitting a frame on to a LAN through that port. It is recommended to assign this value according to the speed of the bridge. The slower the media, the higher the cost - see Table 24 on page 110 for more information.
Add	Click **Add** to save this MST instance to the Switch's run-time memory. The Switch loses this change if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Instance	This field displays the ID of an MST instance.
VLAN	This field displays the VID (or VID ranges) to which the MST instance is mapped.
Active Port	This field display the ports configured to participate in the MST instance.
Delete	Check the rule(s) that you want to remove in the **Delete** column and then click the **Delete** button.
Cancel	Click **Cancel** to begin configuring this screen afresh.

11.9 Multiple Spanning Tree Protocol Status

Click **Advanced Application** > **Spanning Tree Protocol** in the navigation panel to display the status screen as shown next. See Section 11.1.5 on page 112 for more information on MSTP.

This screen is only available after you activate MSTP on the Switch.

Figure 61 Advanced Application > Spanning Tree Protocol > Status: MSTP



The following table describes the labels in this screen.

Table 32 Advanced Application > Spanning Tree Protocol > Status: MSTP

LABEL	DESCRIPTION
Configuration	Click **Configuration** to specify which STP mode you want to activate. Click **MSTP** to edit MSTP settings on the Switch.
CST	This section describes the Common Spanning Tree settings.
Bridge	**Root** refers to the base of the spanning tree (the root bridge). **Our Bridge** is this Switch. This Switch may also be the root bridge.
Bridge ID	This is the unique identifier for this bridge, consisting of bridge priority plus MAC address. This ID is the same for **Root** and **Our Bridge** if the Switch is the root switch.
Hello Time (second)	This is the time interval (in seconds) at which the root switch transmits a configuration message.
Max Age (second)	This is the maximum time (in seconds) a switch can wait without receiving a configuration message before attempting to reconfigure.

Table 32 Advanced Application > Spanning Tree Protocol > Status: MSTP (continued)

LABEL	DESCRIPTION
Forwarding Delay (second)	This is the time (in seconds) the root switch will wait before changing states (that is, listening to learning to forwarding).
Cost to Bridge	This is the path cost from the root port on this Switch to the root switch.
Port ID	This is the priority and number of the port on the Switch through which this Switch must communicate with the root of the Spanning Tree.
Configuration Name	This field displays the configuration name for this MST region.
Revision Number	This field displays the revision number for this MST region.
Configuration Digest	A configuration digest is generated from the VLAN-MSTI mapping information. This field displays the 16-octet signature that is included in an MSTP BPDU. This field displays the digest when MSTP is activated on the system.
Topology Changed Times	This is the number of times the spanning tree has been reconfigured.
Time Since Last Change	This is the time since the spanning tree was last reconfigured.
Instance:	These fields display the MSTI to VLAN mapping. In other words, which VLANs run on each spanning tree instance.
Instance	This field displays the MSTI ID.
VLAN	This field displays which VLANs are mapped to an MSTI.
MSTI	Select the MST instance settings you want to view.
Bridge	**Root** refers to the base of the MST instance. **Our Bridge** is this Switch. This Switch may also be the root bridge.
Bridge ID	This is the unique identifier for this bridge, consisting of bridge priority plus MAC address. This ID is the same for **Root** and **Our Bridge** if the Switch is the root switch.
Internal Cost	This is the path cost from the root port in this MST instance to the regional root switch.
Port ID	This is the priority and number of the port on the Switch through which this Switch must communicate with the root of the MST instance.

12

Bandwidth Control

This chapter shows you how you can cap the maximum bandwidth using the **Bandwidth Control** screen.

12.1 Bandwidth Control Overview

Bandwidth control means defining a maximum allowable bandwidth for incoming and/or out-going traffic flows on a port.

12.1.1 CIR and PIR

The Committed Information Rate (CIR) is the guaranteed bandwidth for the incoming traffic flow on a port. The Peak Information Rate (PIR) is the maximum bandwidth allowed for the incoming traffic flow on a port when there is no network congestion.

The CIR and PIR should be set for all ports that use the same uplink bandwidth. If the CIR is reached, packets are sent at the rate up to the PIR. When network congestion occurs, packets through the ingress port exceeding the CIR will be marked for drop.



The CIR should be less than the PIR.

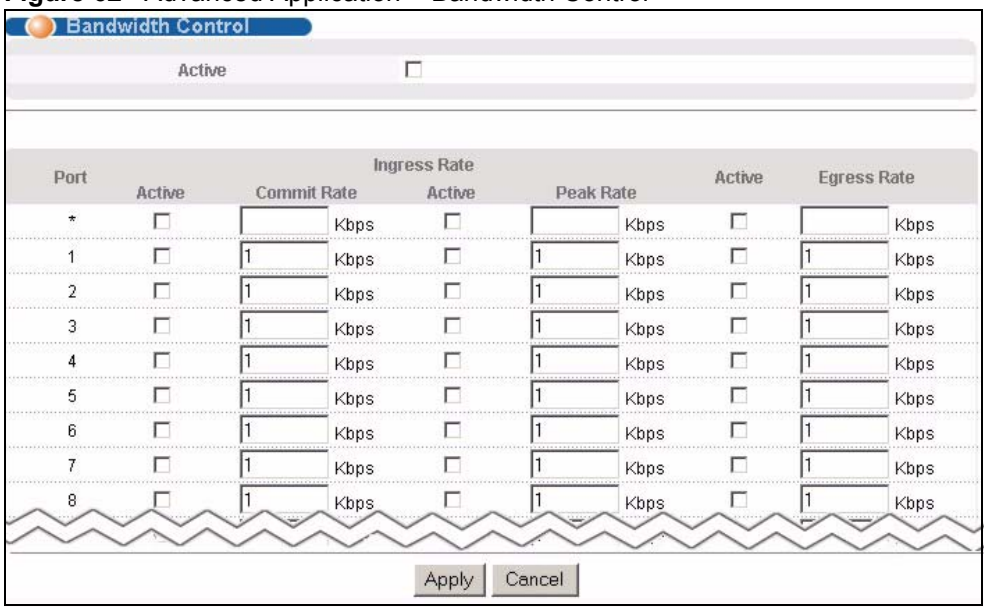


The sum of CIRs cannot be greater than or equal to the uplink bandwidth.

12.2 Bandwidth Control Setup

Click **Advanced Application > Bandwidth Control** in the navigation panel to bring up the screen as shown next.

Figure 62 Advanced Application > Bandwidth Control



The following table describes the related labels in this screen.

Table 33 Advanced Application > Bandwidth Control

LABEL	DESCRIPTION
Active	Select this check box to enable bandwidth control on the Switch.
Port	This field displays the port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Ingress Rate	
Active	Select this check box to activate commit rate limits on this port.
Commit Rate	Specify the guaranteed bandwidth allowed in kilobits per second (Kbps) for the incoming traffic flow on a port. The commit rate should be less than the peak rate. The sum of commit rates cannot be greater than or equal to the uplink bandwidth.
Active	Select this check box to activate peak rate limits on this port.
Peak Rate	Specify the maximum bandwidth allowed in kilobits per second (Kbps) for the incoming traffic flow on a port.
Active	Select this check box to activate egress rate limits on this port.
Egress Rate	Specify the maximum bandwidth allowed in kilobits per second (Kbps) for the out-going traffic flow on a port.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

13

Broadcast Storm Control

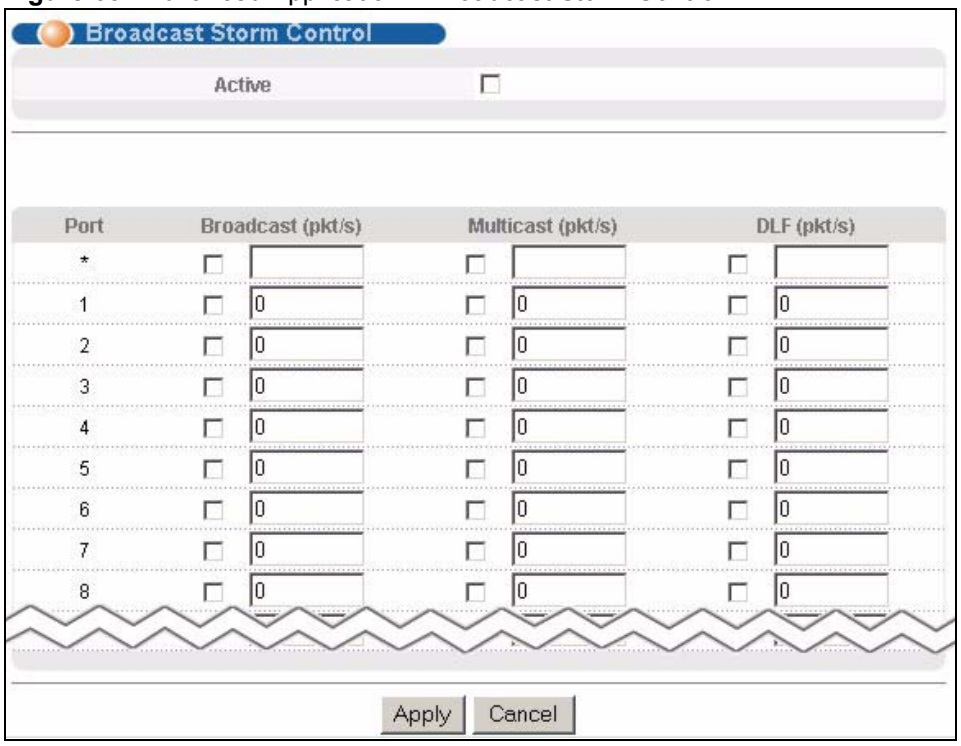
This chapter introduces and shows you how to configure the broadcast storm control feature.

13.1 Broadcast Storm Control Setup

Broadcast storm control limits the number of broadcast, multicast and destination lookup failure (DLF) packets the Switch receives per second on the ports. When the maximum number of allowable broadcast, multicast and/or DLF packets is reached per second, the subsequent packets are discarded. Enable this feature to reduce broadcast, multicast and/or DLF packets in your network. You can specify limits for each packet type on each port.

Click **Advanced Application** > **Broadcast Storm Control** in the navigation panel to display the screen as shown next.

Figure 63 Advanced Application > Broadcast Storm Control



The following table describes the labels in this screen.

Table 34 Advanced Application > Broadcast Storm Control

LABEL	DESCRIPTION
Active	Select this check box to enable traffic storm control on the Switch. Clear this check box to disable this feature.
Port	This field displays a port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Broadcast (pkt/s)	Select this option and specify how many broadcast packets the port receives per second.
Multicast (pkt/s)	Select this option and specify how many multicast packets the port receives per second.
DLF (pkt/s)	Select this option and specify how many destination lookup failure (DLF) packets the port receives per second.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

14 Mirroring

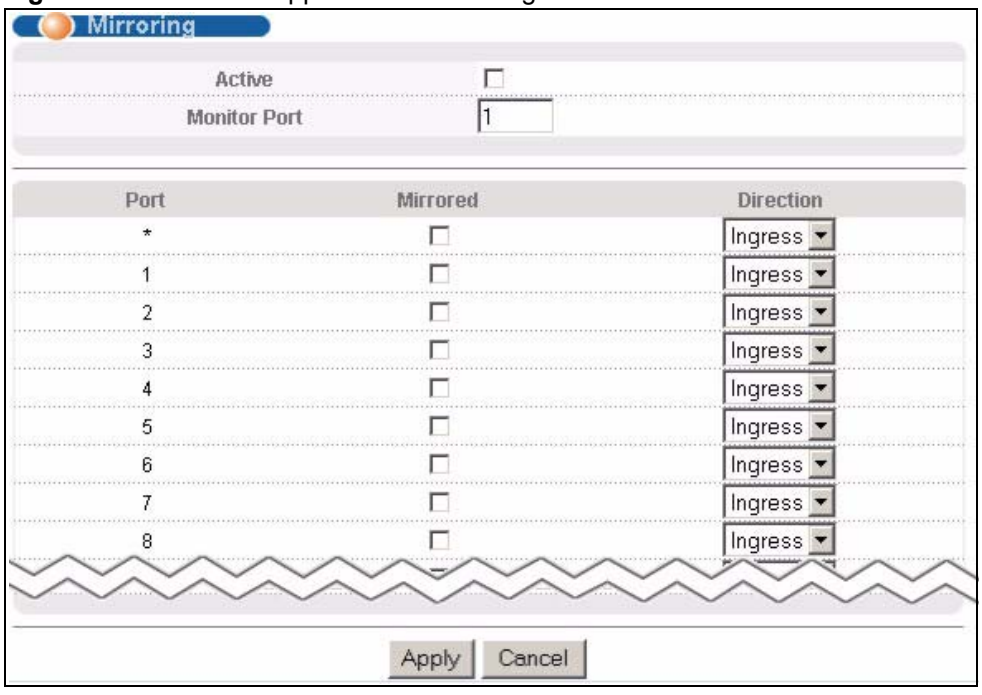
This chapter discusses port mirroring setup screens.

14.1 Port Mirroring Setup

Port mirroring allows you to copy a traffic flow to a monitor port (the port you copy the traffic to) in order that you can examine the traffic from the monitor port without interference.

Click **Advanced Application** > **Mirroring** in the navigation panel to display the **Mirroring** screen. Use this screen to select a monitor port and specify the traffic flow to be copied to the monitor port.

Figure 64 Advanced Application > Mirroring



The following table describes the labels in this screen.

Table 35 Advanced Application > Mirroring

LABEL	DESCRIPTION
Active	Select this check box to activate port mirroring on the Switch. Clear this check box to disable the feature.
Monitor Port	The monitor port is the port you copy the traffic to in order to examine it in more detail without interfering with the traffic flow on the original port(s). Enter the port number of the monitor port.
Port	This field displays the port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Mirrored	Select this option to mirror the traffic on a port.
Direction	Specify the direction of the traffic to mirror by selecting from the drop-down list box. Choices are **Egress** (outgoing), **Ingress** (incoming) and **Both**.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

15

Link Aggregation

This chapter shows you how to logically aggregate physical links to form one logical, higher-bandwidth link.

15.1 Link Aggregation Overview

Link aggregation (trunking) is the grouping of physical ports into one logical higher-capacity link. You may want to trunk ports if for example, it is cheaper to use multiple lower-speed links than to under-utilize a high-speed, but more costly, single-port link.

However, the more ports you aggregate then the fewer available ports you have. A trunk group is one logical link containing multiple ports.

The beginning port of each trunk group must be physically connected to form a trunk group.

The Switch supports both static and dynamic link aggregation.



In a properly planned network, it is recommended to implement static link aggregation only. This ensures increased network stability and control over the trunk groups on your Switch.

See Section 15.6 on page 138 for a static port trunking example.

15.2 Dynamic Link Aggregation

The Switch adheres to the IEEE 802.3ad standard for static and dynamic (LACP) port trunking.

The Switch supports the link aggregation IEEE802.3ad standard. This standard describes the Link Aggregation Control Protocol (LACP), which is a protocol that dynamically creates and manages trunk groups.

When you enable LACP link aggregation on a port, the port can automatically negotiate with the ports at the remote end of a link to establish trunk groups. LACP also allows port redundancy, that is, if an operational port fails, then one of the “standby” ports become operational without user intervention. Please note that:

- You must connect all ports point-to-point to the same Ethernet switch and configure the ports for LACP trunking.
- LACP only works on full-duplex links.
- All ports in the same trunk group must have the same media type, speed, duplex mode and flow control settings.

Configure trunk groups or LACP before you connect the Ethernet switch to avoid causing network topology loops.

15.2.1 Link Aggregation ID

LACP aggregation ID consists of the following information[1]:

Table 36 Link Aggregation ID: Local Switch

SYSTEM PRIORITY	MAC ADDRESS	KEY	PORT PRIORITY	PORT NUMBER
0000	00-00-00-00-00-00	0000	00	0000

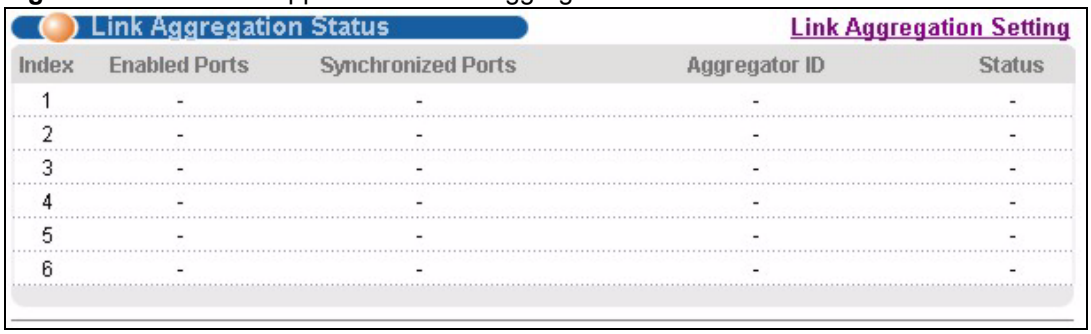
Table 37 Link Aggregation ID: Peer Switch

SYSTEM PRIORITY	MAC ADDRESS	KEY	PORT PRIORITY	PORT NUMBER
0000	00-00-00-00-00-00	0000	00	0000

15.3 Link Aggregation Status

Click **Advanced Application** > **Link Aggregation** in the navigation panel. The **Link Aggregation Status** screen displays by default. See Section 15.1 on page 133 for more information.

Figure 65 Advanced Application > Link Aggregation Status



The following table describes the labels in this screen.

Table 38 Advanced Application > Link Aggregation Status

LABEL	DESCRIPTION
Index	This field displays the trunk ID to identify a trunk group, that is, one logical link containing multiple ports.
Enabled Port	These are the ports you have configured in the **Link Aggregation** screen to be in the trunk group.

1. Port Priority and Port Number are 0 as it is the aggregator ID for the trunk group, not the individual port.

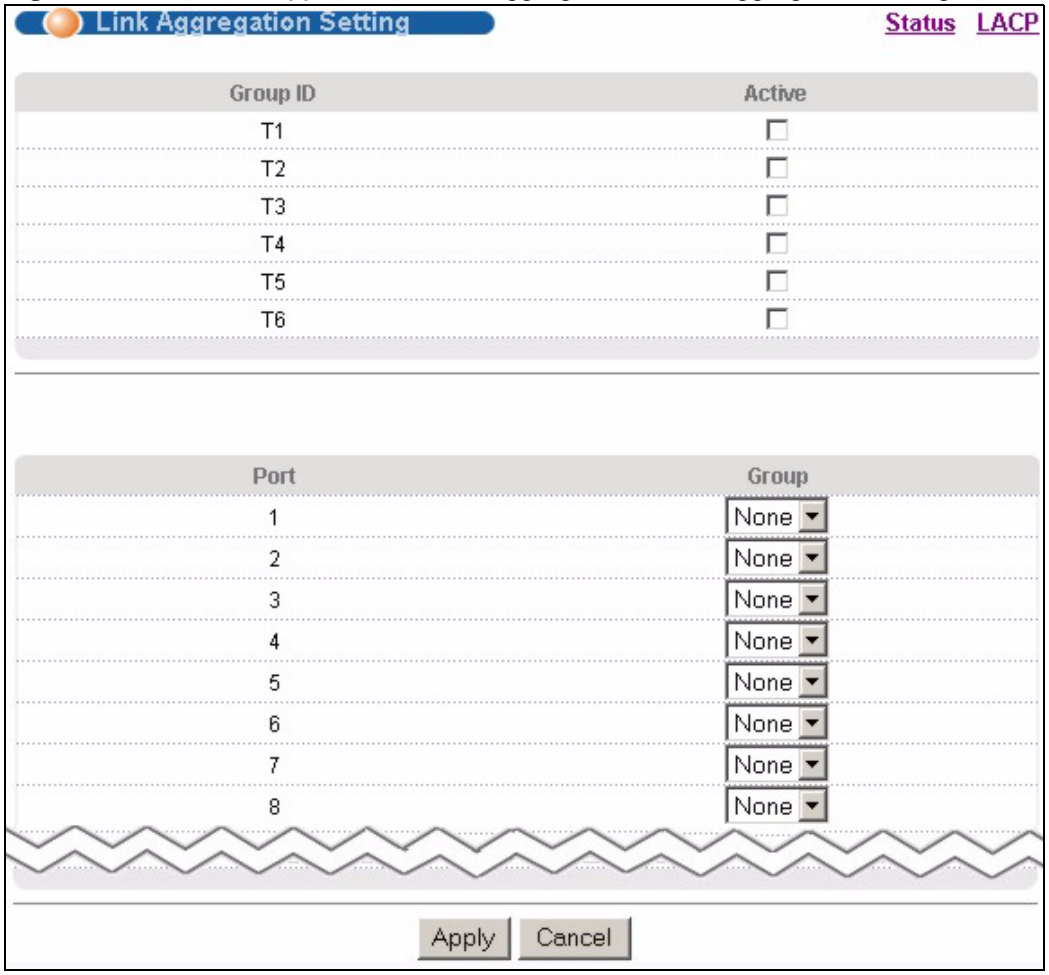
Table 38 Advanced Application > Link Aggregation Status (continued)

LABEL	DESCRIPTION
Synchronized Ports	These are the ports that are currently transmitting data as one logical link in this trunk group.
Aggregator ID	Link Aggregator ID consists of the following: system priority, MAC address, key, port priority and port number. Refer to Section 15.2.1 on page 134 for more information on this field.
Status	This field displays how these ports were added to the trunk group. It displays: • **Static** - if the ports are configured as static members of a trunk group. • **LACP** - if the ports are configured to join a trunk group via LACP.

15.4 Link Aggregation Setting

Click **Advanced Application** > **Link Aggregation > Link Aggregation Setting** to display the screen shown next. See Section 15.1 on page 133 for more information on link aggregation.

Figure 66 Advanced Application > Link Aggregation > Link Aggregation Setting



The following table describes the labels in this screen.

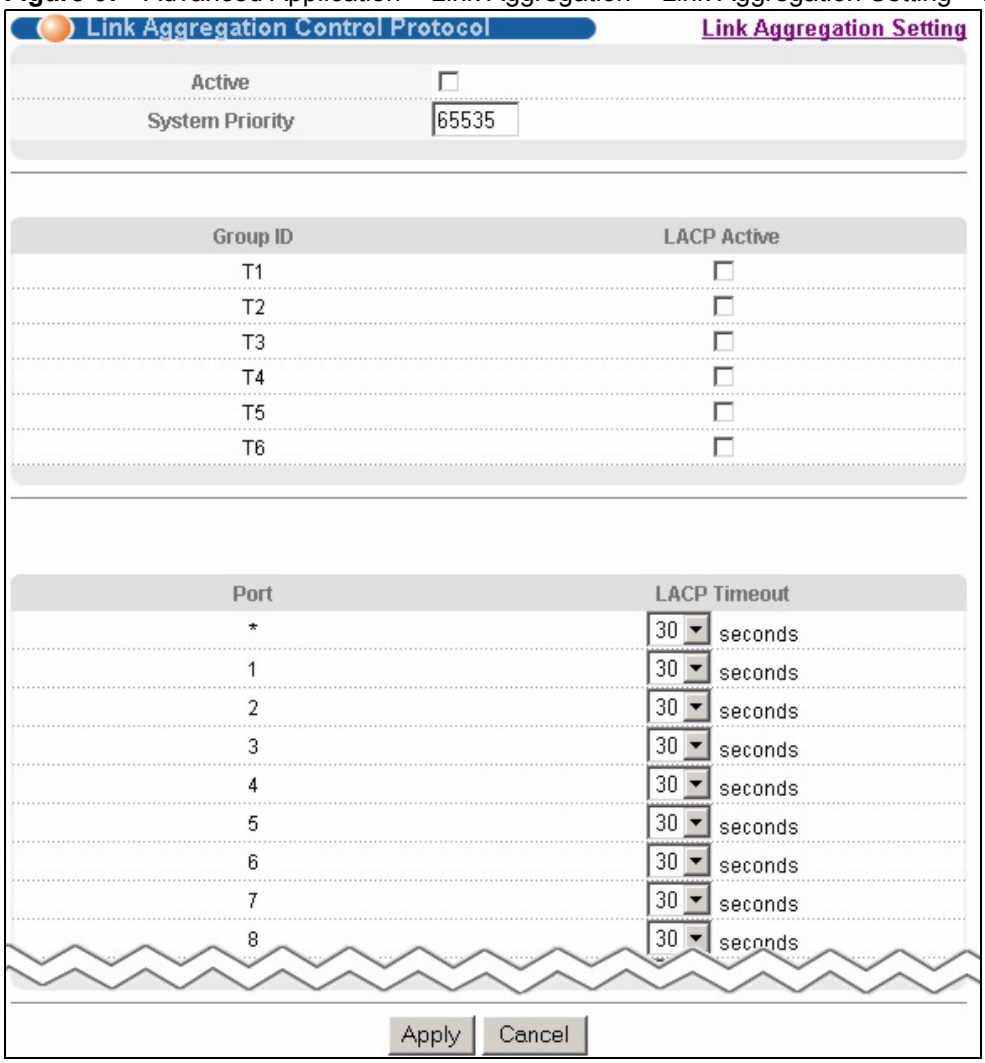
Table 39 Advanced Application > Link Aggregation > Link Aggregation Setting

LABEL	DESCRIPTION
Link Aggregation Setting	This is the only screen you need to configure to enable static link aggregation.
Group ID	The field identifies the link aggregation group, that is, one logical link containing multiple ports.
Active	Select this option to activate a trunk group.
Port	This field displays the port number.
Group	Select the trunk group to which a port belongs.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

15.5 Link Aggregation Control Protocol

Click in the **Advanced Application** > **Link Aggregation** > **Link Aggregation Setting** > **LACP** to display the screen shown next. See Section 15.2 on page 133 for more information on dynamic link aggregation.

Figure 67 Advanced Application > Link Aggregation > Link Aggregation Setting > LACP



The following table describes the labels in this screen.

Table 40 Advanced Application > Link Aggregation > Link Aggregation Setting > LACP

LABEL	DESCRIPTION
Link Aggregation Control Protocol	Note: Do not configure this screen unless you want to enable dynamic link aggregation.
Active	Select this checkbox to enable Link Aggregation Control Protocol (LACP).
System Priority	LACP system priority is a number between 1 and 65,535. The switch with the lowest system priority (and lowest port number if system priority is the same) becomes the LACP “server”. The LACP “server” controls the operation of LACP setup. Enter a number to set the priority of an active port using Link Aggregate Control Protocol (LACP). The smaller the number, the higher the priority level.
Group ID	The field identifies the link aggregation group, that is, one logical link containing multiple ports.
LACP Active	Select this option to enable LACP for a trunk.
Port	This field displays the port number.

Table 40 Advanced Application > Link Aggregation > Link Aggregation Setting > LACP

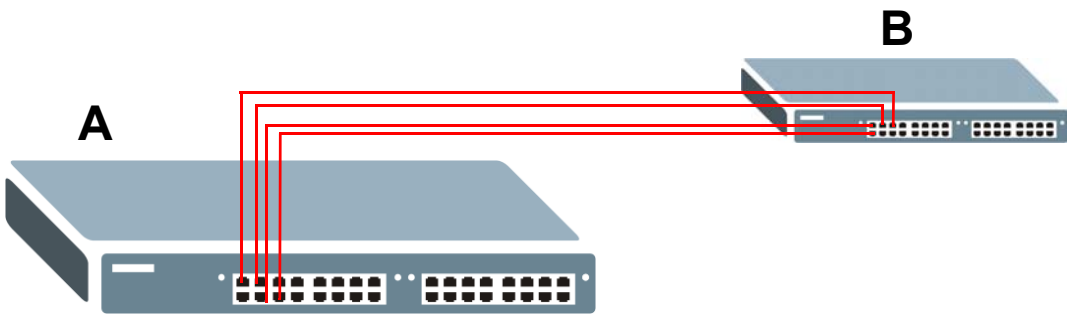
LABEL	DESCRIPTION
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
LACP Timeout	Timeout is the time interval between the individual port exchanges of LACP packets in order to check that the peer port in the trunk group is still up. If a port does not respond after three tries, then it is deemed to be “down” and is removed from the trunk. Set a short timeout (one second) for busy trunked links to ensure that disabled ports are removed from the trunk group as soon as possible. Select either 1 second or 30 seconds.
Apply	Click **Apply** to save your changes to the Switch’s run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

15.6 Static Trunking Example

This example shows you how to create a static port trunk group for ports 2-5.

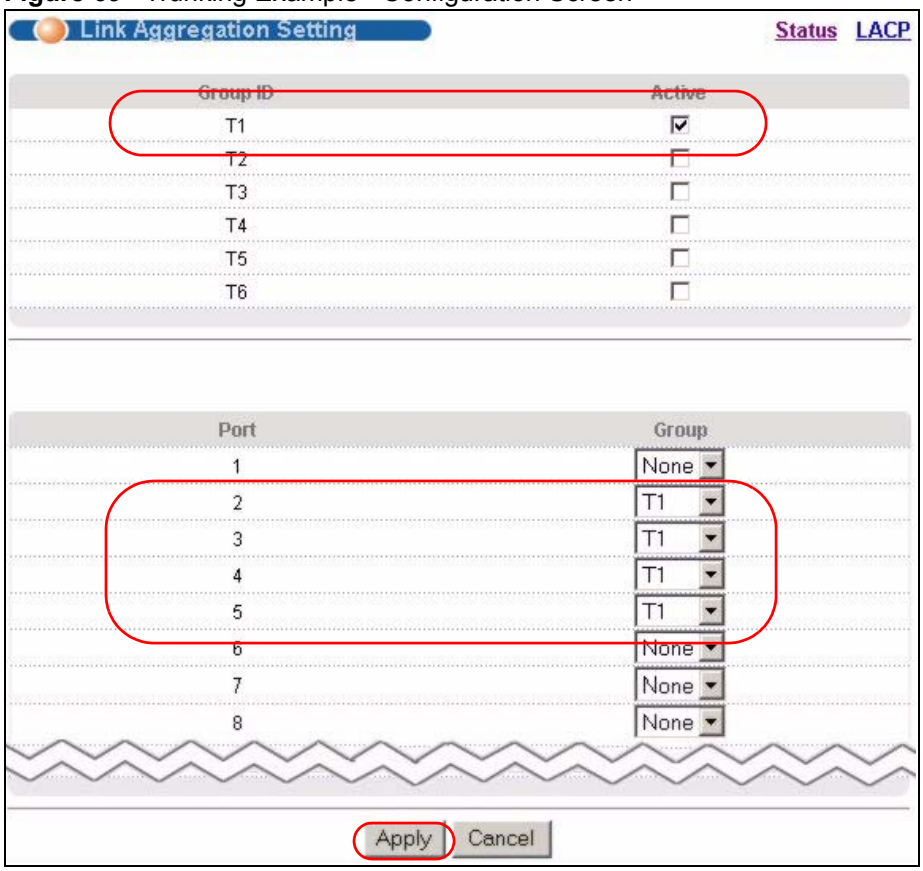
1 **Make your physical connections** - make sure that the ports that you want to belong to the trunk group are connected to the same destination. The following figure shows ports 2-5 on switch **A** connected to switch **B**.

Figure 68 Trunking Example - Physical Connections



2 **Configure static trunking** - Click **Advanced Application** > **Link Aggregation** > **Link Aggregation Setting**. In this screen activate trunking group **T1** and select the ports that should belong to this group as shown in the figure below. Click **Apply** when you are done.

Figure 69 Trunking Example - Configuration Screen



Your trunk group 1 (**T1**) configuration is now complete; you do not need to go to any additional screens.

16

Port Authentication

This chapter describes the IEEE 802.1x and MAC authentication methods.

16.1 Port Authentication Overview

Port authentication is a way to validate access to ports on the Switch to clients based on an external server (authentication server). The Switch supports the following methods for port authentication:

- **IEEE 802.1x**[2] - An authentication server validates access to a port based on a username and password provided by the user.
- **MAC** - An authentication server validates access to a port based on the MAC address and password of the client.

Both types of authentication use the RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) protocol to validate users. See Section 23.1.2 on page 188 for more information on configuring your RADIUS server settings.



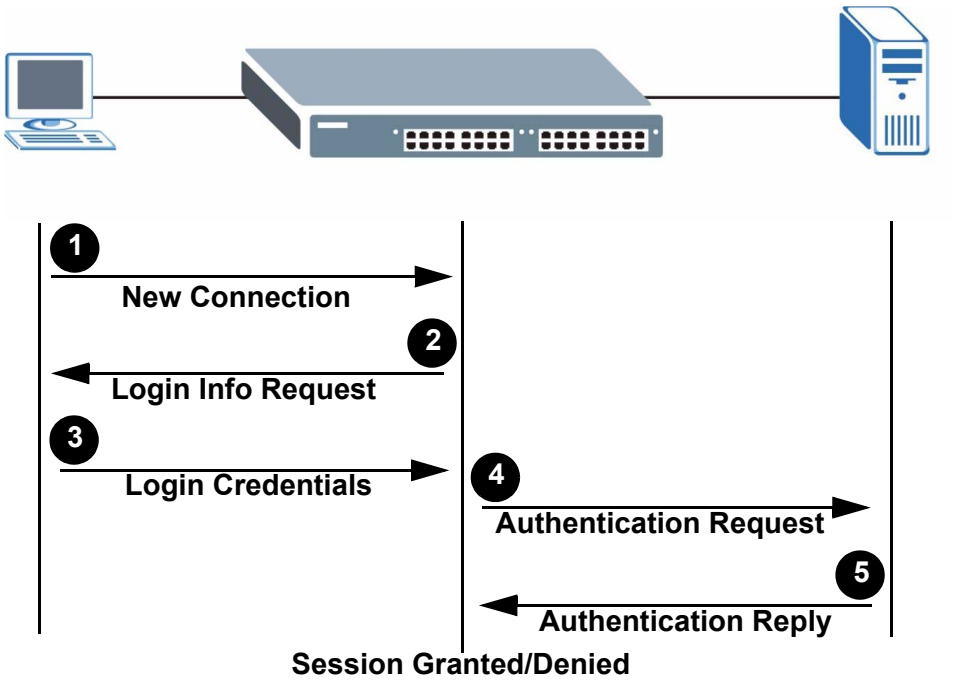
If you enable IEEE 802.1x authentication and MAC authentication on the same port, the Switch performs IEEE 802.1x authentication first. If a user fails to authenticate via the IEEE 802.1x method, then access to the port is denied.

16.1.1 IEEE 802.1x Authentication

The following figure illustrates how a client connecting to a IEEE 802.1x authentication enabled port goes through a validation process. The Switch prompts the client for login information in the form of a user name and password. When the client provides the login credentials, the Switch sends an authentication request to a RADIUS server. The RADIUS server validates whether this client is allowed access to the port.

2. At the time of writing, IEEE 802.1x is not supported by all operating systems. See your operating system documentation. If your operating system does not support 802.1x, then you may need to install 802.1x client software.

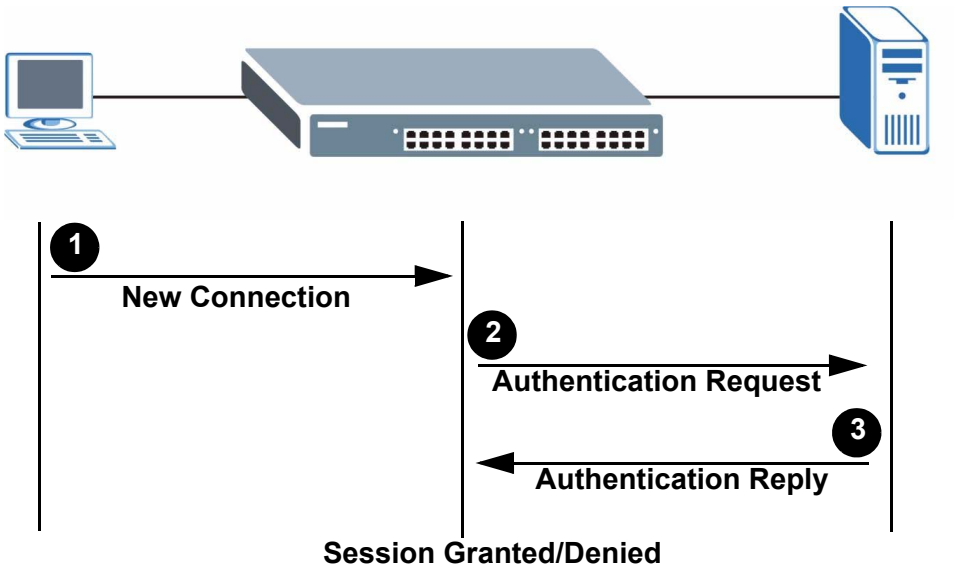
Figure 70 IEEE 802.1x Authentication Process



16.1.2 MAC Authentication

MAC authentication works in a very similar way to IEEE 802.1x authentication. The main difference is that the Switch does not prompt the client for login credentials. The login credentials are based on the source MAC address of the client connecting to a port on the Switch along with a password configured specifically for MAC authentication on the Switch.

Figure 71 MAC Authentication Process



16.2 Port Authentication Configuration

To enable port authentication, first activate the port authentication method(s) you want to use (both on the Switch and the port(s)) then configure the RADIUS server settings in the **Auth and Acct > Radius Server Setup** screen.

Click **Advanced Application** > **Port Authentication** in the navigation panel to display the screen as shown.

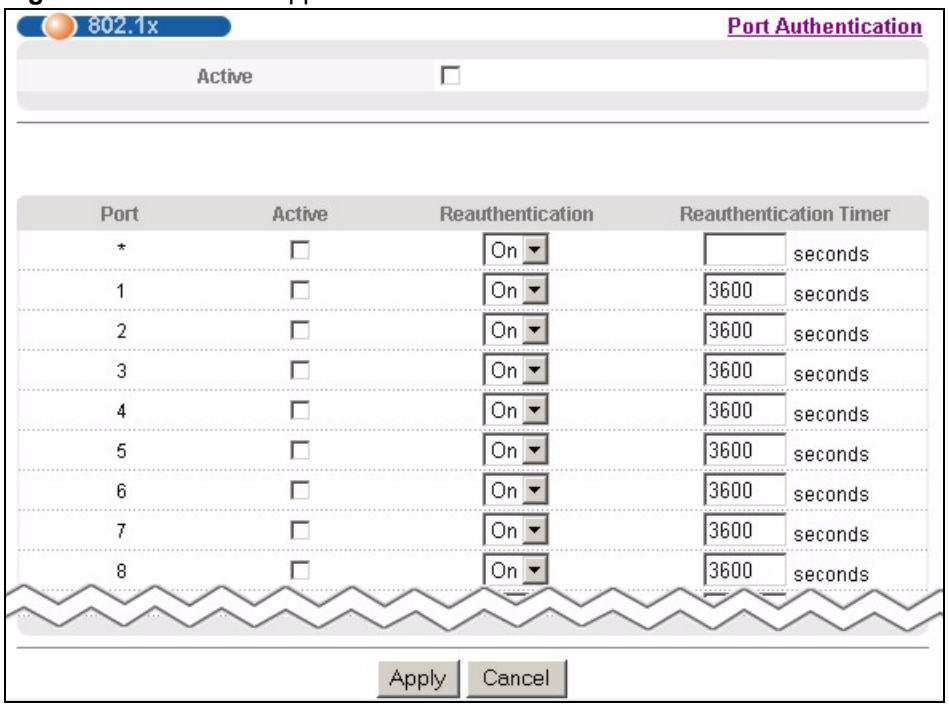
Figure 72 Advanced Application > Port Authentication



16.2.1 Activate IEEE 802.1x Security

Use this screen to activate IEEE 802.1x security. In the **Port Authentication** screen click **802.1x** to display the configuration screen as shown.

Figure 73 Advanced Application > Port Authentication > 802.1x



The following table describes the labels in this screen.

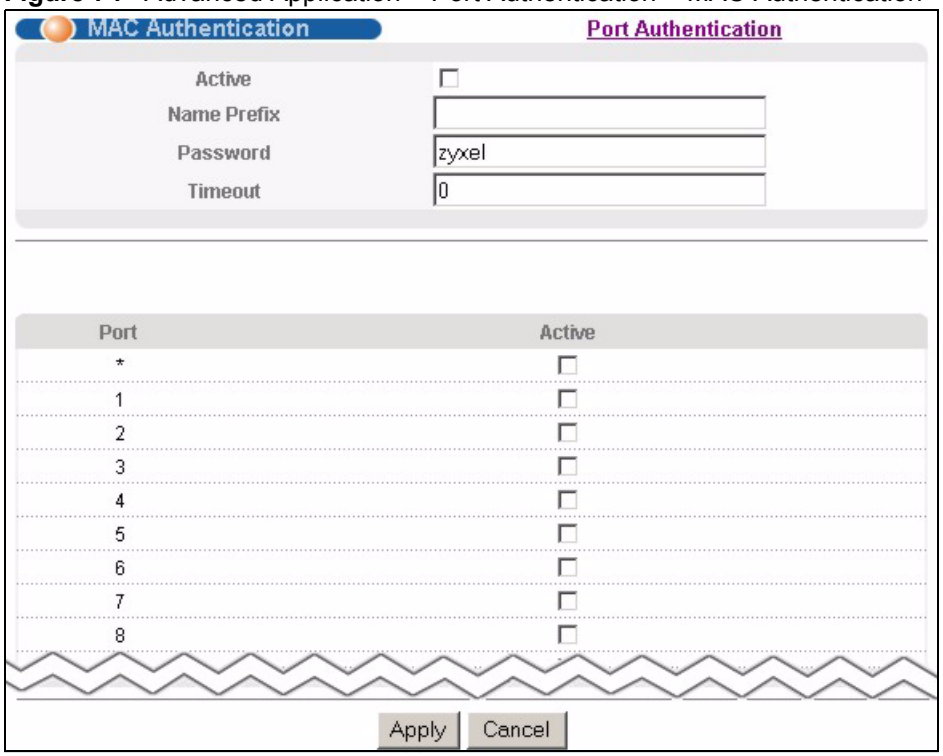
Table 41 Advanced Application > Port Authentication > 802.1x

LABEL	DESCRIPTION
Active	Select this check box to permit 802.1x authentication on the Switch. Note: You must first enable 802.1x authentication on the Switch before configuring it on each port.
Port	This field displays a port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this to permit 802.1x authentication on this port. You must first allow 802.1x authentication on the Switch before configuring it on each port.
Reauthentication	Specify if a subscriber has to periodically re-enter his or her username and password to stay connected to the port.
Reauthentication Timer	Specify how often a client has to re-enter his or her username and password to stay connected to the port.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

16.2.2 Activate MAC Authentication

Use this screen to activate MAC authentication. In the **Port Authentication** screen click **MAC Authentication** to display the configuration screen as shown.

Figure 74 Advanced Application > Port Authentication > MAC Authentication



The following table describes the labels in this screen.

Table 42 Advanced Application > Port Authentication > MAC Authentication

LABEL	DESCRIPTION
Active	Select this check box to permit MAC authentication on the Switch. Note: You must first enable MAC authentication on the Switch before configuring it on each port.
Name Prefix	Type the prefix that is appended to all MAC addresses sent to the RADIUS server for authentication. You can enter up to 32 printable ASCII characters. If you leave this field blank, then only the MAC address of the client is forwarded to the RADIUS server.
Password	Type the password the Switch sends along with the MAC address of a client for authentication with the RADIUS server. You can enter up to 32 printable ASCII characters.
Timeout	Specify the amount of time before the Switch allows a client MAC address that fails authentication to try and authenticate again. Maximum time is 3000 seconds. When a client fails MAC authentication, its MAC address is learned by the MAC address table with a status of denied. The timeout period you specify here is the time the MAC address entry stays in the MAC address table until it is cleared. If you specify 0 for the timeout value, then this entry will not be deleted from the MAC address table. Note: If the **Aging Time** in the **Switch Setup** screen is set to a lower value, then it supersedes this setting. See Section 7.5 on page 81.
Port	This field displays a port number.

Table 42 Advanced Application > Port Authentication > MAC Authentication (continued)

LABEL	DESCRIPTION
*	Use this row to make the setting the same for all ports. Use this row first and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this to permit MAC authentication on this port. You must first allow MAC authentication on the Switch before configuring it on each port.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17

Port Security

This chapter shows you how to set up port security.

17.1 About Port Security

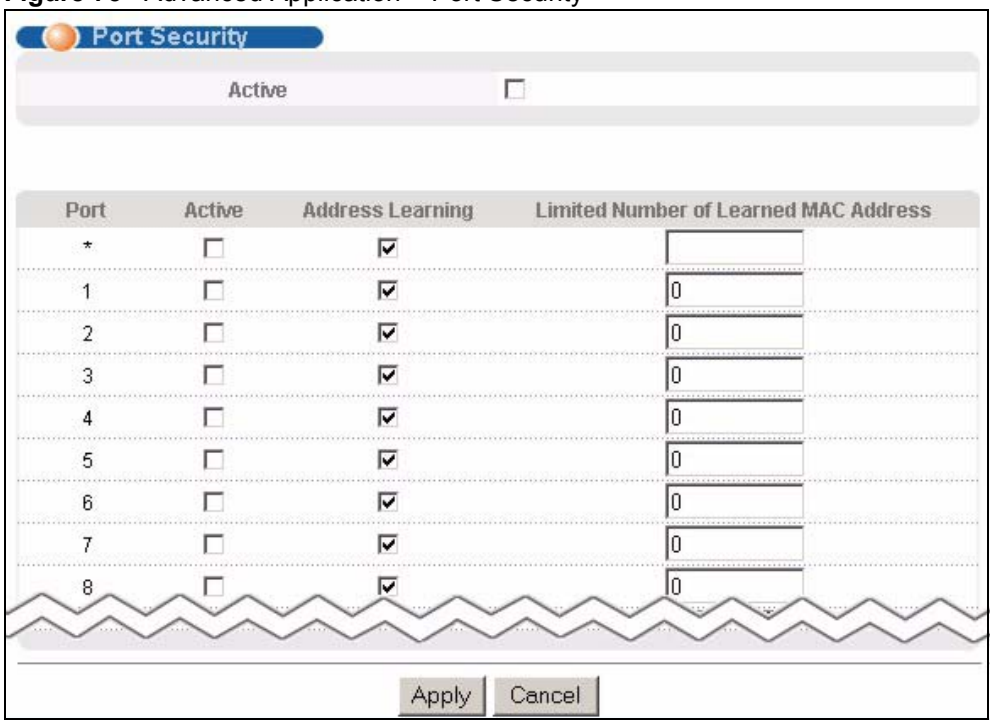
Port security allows only packets with dynamically learned MAC addresses and/or configured static MAC addresses to pass through a port on the Switch. The Switch can learn up to 16K MAC addresses in total with no limit on individual ports other than the sum cannot exceed 16K.

For maximum port security, enable this feature, disable MAC address learning and configure static MAC address(es) for a port. It is not recommended you disable port security together with MAC address learning as this will result in many broadcasts. By default, MAC address learning is still enabled even though the port security is not activated.

17.2 Port Security Setup

Click **Advanced Application** > **Port Security** in the navigation panel to display the screen as shown.

Figure 75 Advanced Application > Port Security



The following table describes the labels in this screen.

Table 43 Advanced Application > Port Security

LABEL	DESCRIPTION
Active	Select this option to enable port security on the Switch.
Port	This field displays a port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this check box to enable the port security feature on this port. The Switch forwards packets whose MAC address(es) is in the MAC address table on this port. Packets with no matching MAC address(es) are dropped. Clear this check box to disable the port security feature. The Switch forwards all packets on this port.
Address Learning	MAC address learning reduces outgoing broadcast traffic. For MAC address learning to occur on a port, the port itself must be active with address learning enabled.
Limited Number of Learned MAC Address	Use this field to limit the number of (dynamic) MAC addresses that may be learned on a port. For example, if you set this field to "5" on port 2, then only the devices with these five learned MAC addresses may access port 2 at any one time. A sixth device would have to wait until one of the five learned MAC addresses aged out. MAC address aging out time can be set in the **Switch Setup** screen. The valid range is from “0” to “16384”. “0” means this feature is disabled.

Table 43 Advanced Application > Port Security (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

18

Classifier

This chapter introduces and shows you how to configure the packet classifier on the Switch.

18.1 About the Classifier and QoS

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to control the use of bandwidth. Without QoS, all traffic data is equally likely to be dropped when the network is congested. This can cause a reduction in network performance and make the network inadequate for time-critical application such as video-on-demand.

A classifier groups traffic into data flows according to specific criteria such as the source address, destination address, source port number, destination port number or incoming port number. For example, you can configure a classifier to select traffic from the same protocol port (such as Telnet) to form a flow.

Configure QoS on the Switch to group and prioritize application traffic and fine-tune network performance. Setting up QoS involves two separate steps:

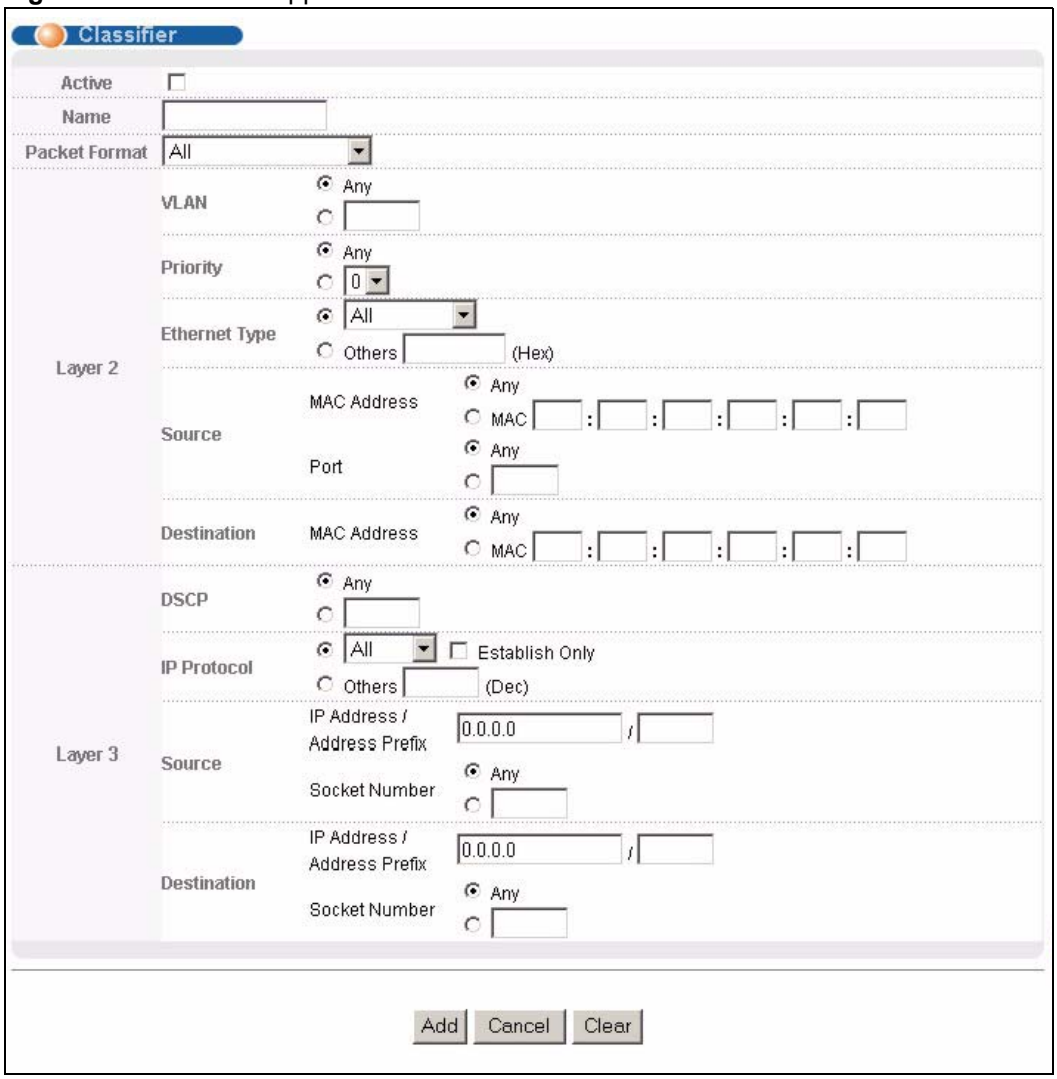
1. Configure classifiers to sort traffic into different flows.
2. Configure policy rules to define actions to be performed for a classified traffic flow (refer to Chapter 19 on page 157 to configure policy rules).

18.2 Configuring the Classifier

Use the **Classifier** screen to define the classifiers. After you define the classifier, you can specify actions (or policy) to act upon the traffic that matches the rules. To configure policy rules, refer to Chapter 19 on page 157.

Click **Advanced Application > Classifier** in the navigation panel to display the configuration screen as shown.

Figure 76 Advanced Application > Classifier



The following table describes the labels in this screen.

Table 44 Advanced Application > Classifier

LABEL	DESCRIPTION
Active	Select this option to enable this rule.
Name	Enter a descriptive name for this rule for identifying purposes.
Packet Format	Specify the format of the packet. Choices are **All**, **802.3 tagged**, **802.3 untagged**, **Ethernet II tagged** and **Ethernet II untagged**. A value of **802.3** indicates that the packets are formatted according to the IEEE 802.3 standards. A value of **Ethernet II** indicates that the packets are formatted according to RFC 894, Ethernet II encapsulation.
Layer 2 Specify the fields below to configure a layer 2 classifier.	
VLAN	Select **Any** to classify traffic from any VLAN or select the second option and specify the source VLAN ID in the field provided.
Priority	Select **Any** to classify traffic from any priority level or select the second option and specify a priority level in the field provided.

Table 44 Advanced Application > Classifier (continued)

LABEL	DESCRIPTION
Ethernet Type	Select an Ethernet type or select **Other** and enter the Ethernet type number in hexadecimal value. Refer to Table 46 on page 154 for information.
Source	
MAC Address	Select **Any** to apply the rule to all MAC addresses. To specify a source, select the second choice and type a MAC address in valid MAC address format (six hexadecimal character pairs).
Port	Type the port number to which the rule should be applied. You may choose one port only or all ports (**Any**).
Destination	
MAC Address	Select **Any** to apply the rule to all MAC addresses. To specify a destination, select the second choice and type a MAC address in valid MAC address format (six hexadecimal character pairs).
Layer 3 Specify the fields below to configure a layer 3 classifier.	
DSCP	Select **Any** to classify traffic from any DSCP or select the second option and specify a DSCP (DiffServ Code Point) number between 0 and 63 in the field provided.
IP Protocol	Select an IP protocol type or select **Other** and enter the protocol number in decimal value. Refer to Table 48 on page 155 for more information. You may select **Establish Only** for **TCP** protocol type. This means that the Switch will pick out the packets that are sent to establish TCP connections.
Source	
IP Address/ Address Prefix	Enter a source IP address in dotted decimal notation. Specify the address prefix by entering the number of ones in the subnet mask. A subnet mask can be represented by a 32 bit binary notation. For example, the subnet mask “255.255.255.0” can be represented as “11111111.11111111.11111111.00000000”, and counting up the number of ones in this case results in 24.
Socket Number	Note: You must select either **UDP** or **TCP** in the **IP Protocol** field before you configure the socket numbers. Select **Any** to apply the rule to all TCP/UDP protocol port numbers or select the second option and enter a TCP/UDP protocol port number.
Destination	
IP Address/ Address Prefix	Enter a destination IP address in dotted decimal notation. Specify the address prefix by entering the number of ones in the subnet mask. A subnet mask can be represented by a 32 bit binary notation. For example, the subnet mask “255.255.255.0” can be represented as “11111111.11111111.11111111.00000000”, and counting up the number of ones in this case results in 24.
Socket Number	Note: You must select either **UDP** or **TCP** in the **IP Protocol** field before you configure the socket numbers. Select **Any** to apply the rule to all TCP/UDP protocol port numbers or select the second option and enter a TCP/UDP protocol port number.
Add	Click **Add** to insert the entry in the summary table below and save your changes to the Switch’s run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.

Table 44 Advanced Application > Classifier (continued)

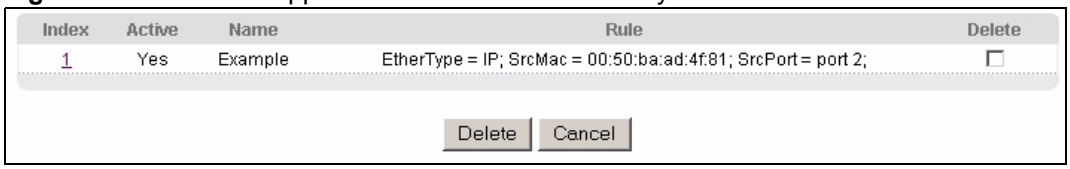
LABEL	DESCRIPTION
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clear	Click **Clear** to set the above fields back to the factory defaults.

18.3 Viewing and Editing Classifier Configuration

To view a summary of the classifier configuration, scroll down to the summary table at the bottom of the **Classifier** screen. To change the settings of a rule, click a number in the **Index** field.

When two rules conflict with each other, a higher layer rule has priority over lower layer rule.

Figure 77 Advanced Application > Classifier: Summary Table



The following table describes the labels in this screen.

Table 45 Classifier: Summary Table

LABEL	DESCRIPTION
Index	This field displays the index number of the rule. Click an index number to edit the rule.
Active	This field displays **Yes** when the rule is activated and **No** when it is deactivated.
Name	This field displays the descriptive name for this rule. This is for identification purpose only.
Rule	This field displays a summary of the classifier rule's settings.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

The following table shows some other common Ethernet types and the corresponding protocol number.

Table 46 Common Ethernet Types and Protocol Number

ETHERNET TYPE	PROTOCOL NUMBER
IP ETHII	0800
X.75 Internet	0801
NBS Internet	0802
ECMA Internet	0803
Chaosnet	0804
X.25 Level 3	0805

Table 46 Common Ethernet Types and Protocol Number (continued)

ETHERNET TYPE	PROTOCOL NUMBER
XNS Compat	0807
Banyan Systems	0BAD
BBN Simnet	5208
IBM SNA	80D5
AppleTalk AARP	80F3

In the Internet Protocol, there is a field called "Protocol" to identify the IP protocol type. The following table shows some common protocol types and the corresponding protocol number. Refer to http://www.iana.org/assignments/protocol-numbers for a complete list.

Table 47 Common IP Protocol Types and Protocol Numbers

PROTOCOL TYPE	PROTOCOL NUMBER
ICMP	1
TCP	6
UDP	17
EGP	8
L2TP	115

Some of the most common IP ports are:

Table 48 Common TCP and UDP Port Numbers

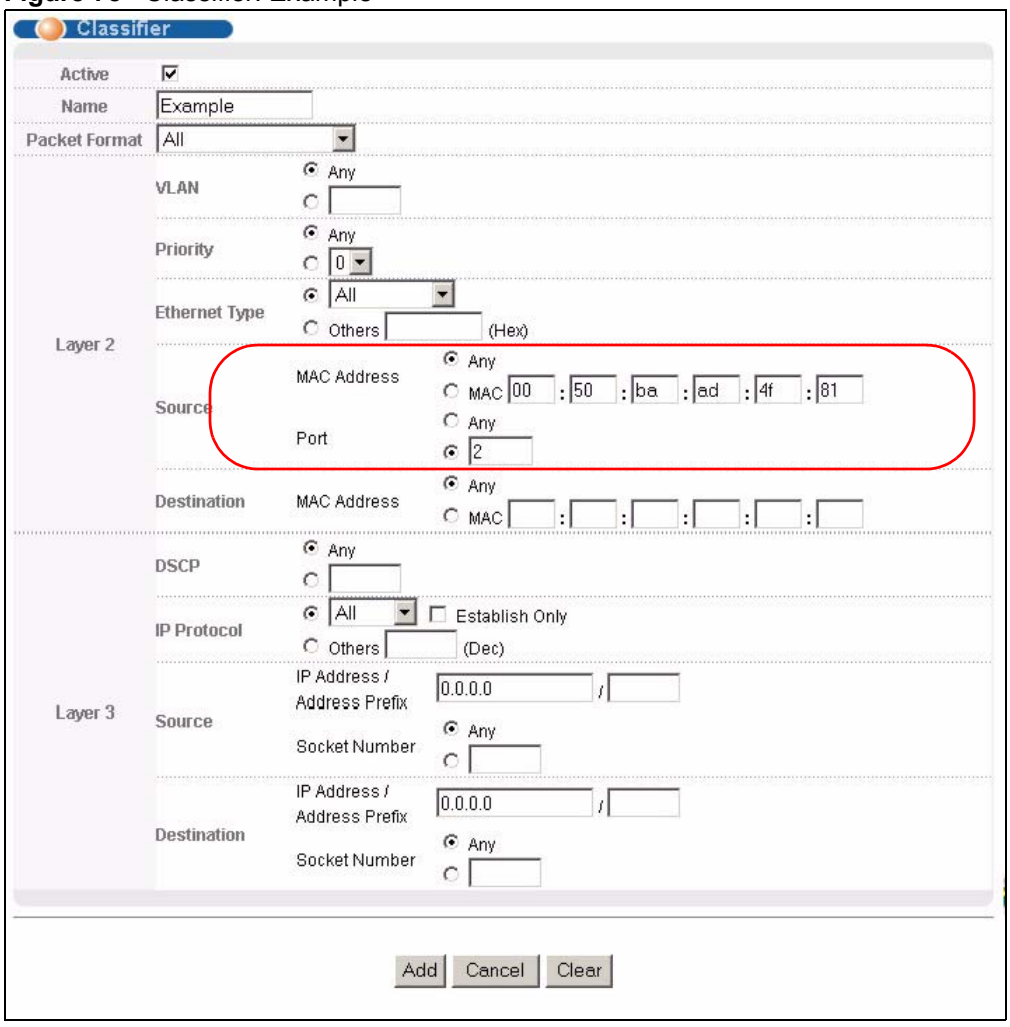
PORT NUMBER	PORT NAME
21	FTP
23	Telnet
25	SMTP
53	DNS
80	HTTP
110	POP3

18.4 Classifier Example

The following screen shows an example where you configure a classifier that identifies all traffic from MAC address 00:50:ba:ad:4f:81 on port 2.

After you have configured a classifier, you can configure a policy (in the **Policy** screen) to define action(s) on the classified traffic flow.

Figure 78 Classifier: Example



19

Policy Rule

This chapter shows you how to configure policy rules.

19.1 Policy Rules Overview

A classifier distinguishes traffic into flows based on the configured criteria (refer to Chapter 18 on page 151 for more information). A policy rule ensures that a traffic flow gets the requested treatment in the network.

19.1.1 DiffServ

DiffServ (Differentiated Services) is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

19.1.2 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

DSCP (6 bits)	Unused (2 bits)

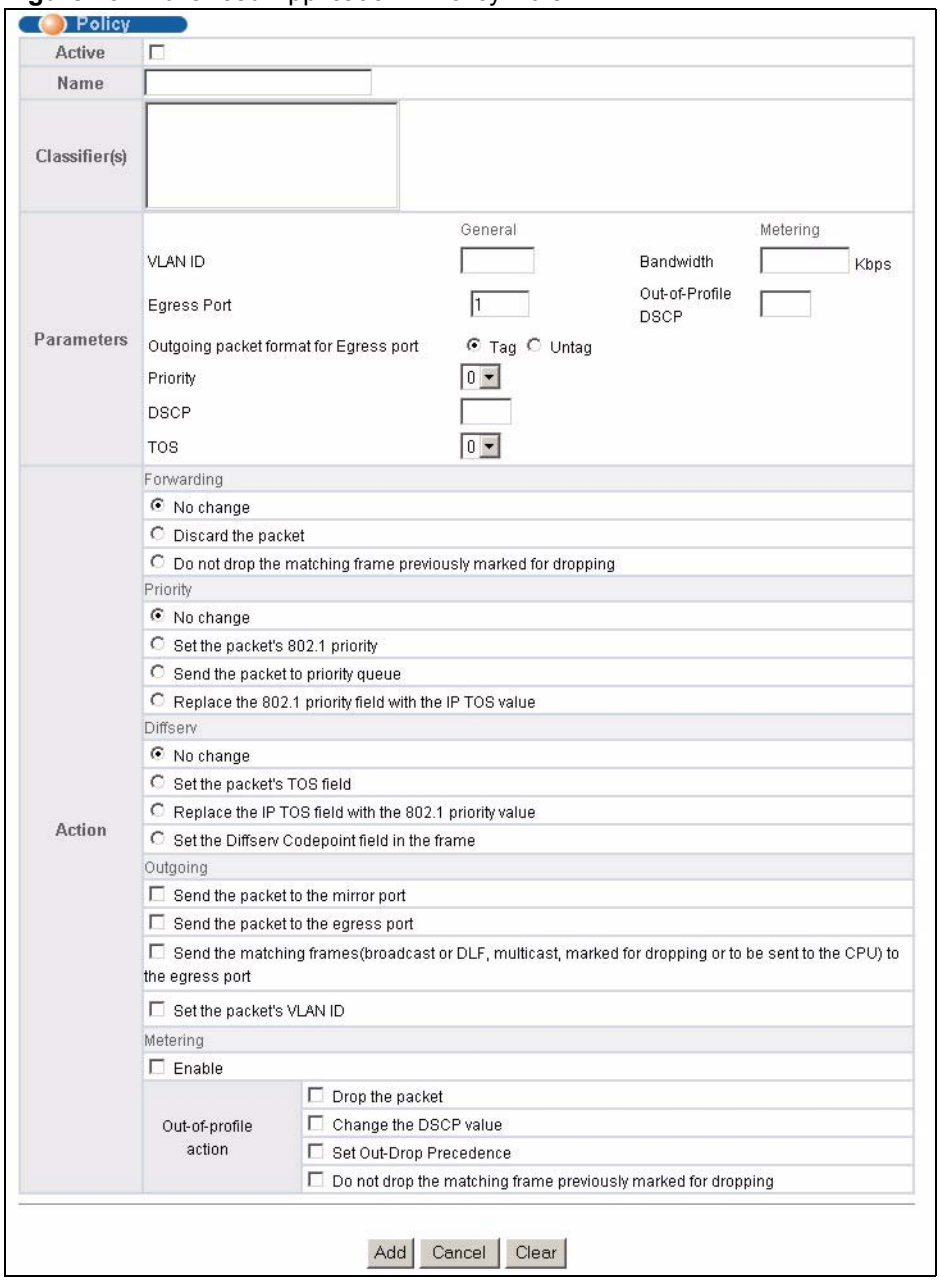
The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different kinds of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

19.2 Configuring Policy Rules

You must first configure a classifier in the **Classifier** screen. Refer to Section 18.2 on page 151 for more information.

Click **Advanced Applications > Policy Rule** in the navigation panel to display the screen as shown.

Figure 79 Advanced Application > Policy Rule



The following table describes the labels in this screen.

Table 49 Advanced Application > Policy Rule

LABEL	DESCRIPTION
Active	Select this option to enable the policy.
Name	Enter a descriptive name for identification purposes.
Classifier(s)	This field displays the active classifier(s) you configure in the **Classifier** screen. Select the classifier(s) to which this policy rule applies. To select more than one classifier, press [SHIFT] and select the choices at the same time.
Parameters Set the fields below for this policy. You only have to set the field(s) that is related to the action(s) you configure in the **Action** field.	
General	
VLAN ID	Specify a VLAN ID number.
Egress Port	Type the number of an outgoing port.
Outgoing packet format for Egress port	Select **Tag** to add the specified VID to packets on the specified outgoing port. Otherwise, select **Untag**.
Priority	Specify a priority level.
DSCP	Specify a DSCP (DiffServ Code Point) number between 0 and 63.
TOS	Specify the type of service (TOS) priority level.
Metering	You can configure the desired bandwidth available to a traffic flow. Traffic that exceeds the maximum bandwidth allocated (in cases where the network is congested) is called out-of-profile traffic.
Bandwidth	Specify the bandwidth in kilobit per second (Kbps). Enter a number between 1 and 1000000.
Out-of-Profile DSCP	Specify a new DSCP number (between 0 and 63) if you want to replace or remark the DSCP number for out-of-profile traffic.
Action Specify the action(s) the Switch takes on the associated classified traffic flow.	
Forwarding	Select **No change** to forward the packets. Select **Discard the packet** to drop the packets. Select **Do not drop the matching frame previously marked for dropping** to retain the frames that were marked to be dropped before.
Priority	Select **No change** to keep the priority setting of the frames. Select **Set the packet's 802.1 priority** to replace the packet's 802.1 priority field with the value you set in the Priority field. Select **Send the packet to priority queue** to put the packets in the designated queue. Select **Replace the 802.1 priority field with the IP TOS value** to replace the packet's 802.1 priority field with the value you set in the **TOS** field.
Diffserv	Select **No change** to keep the TOS and/or DSCP fields in the packets. Select **Set the packet's TOS field** to set the TOS field with the value you configure in the **TOS** field. Select **Replace the IP TOS with the 802.1 priority value** to replace the TOS field with the value you configure in the **Priority** field. Select **Set the Diffserv Codepoint field in the frame** to set the DSCP field with the value you configure in the **DSCP** field.

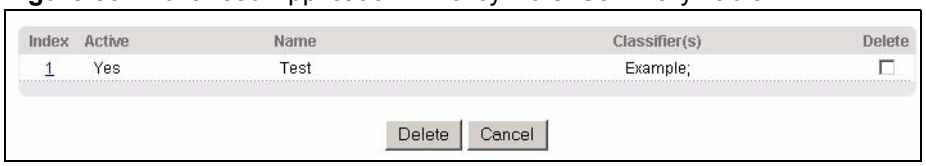
Table 49 Advanced Application > Policy Rule (continued)

LABEL	DESCRIPTION
Outgoing	Select **Send the packet to the mirror port** to send the packet to the mirror port. Select **Send the packet to the egress port** to send the packet to the egress port. Select **Send the matching frames (broadcast or DLF, multicast, marked for dropping or to be sent to the CPU) to the egress port** to send the broadcast, multicast, DLF, marked-to-drop or CPU frames to the egress port. Select **Set the packet's VLAN ID** to set the VLAN ID of the packet with the value you configure in the **VLAN ID** field.
Metering	Select **Enable** to activate bandwidth limitation on the traffic flow(s) then set the actions to be taken on out-of-profile packets.
Out-of-profile action	Select the action(s) to be performed for out-of-profile traffic. Select **Drop the packet** to discard the out-of-profile traffic. Select **Change the DSCP value** to replace the DSCP field with the value specified in the **Out of profile DSCP** field. Select **Set Out-Drop Precedence** to mark out-of-profile traffic and drop it when network is congested. Select **Do not drop the matching frame previously marked for dropping** to queue the frames that are marked to be dropped.
Add	Click **Add** to inset the entry to the summary table below and save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clear	Click **Clear** to set the above fields back to the factory defaults.

19.3 Viewing and Editing Policy Configuration

To view a summary of the classifier configuration, scroll down to the summary table at the bottom of the **Policy** screen. To change the settings of a rule, click a number in the **Index** field.

Figure 80 Advanced Application > Policy Rule: Summary Table



The following table describes the labels in this screen.

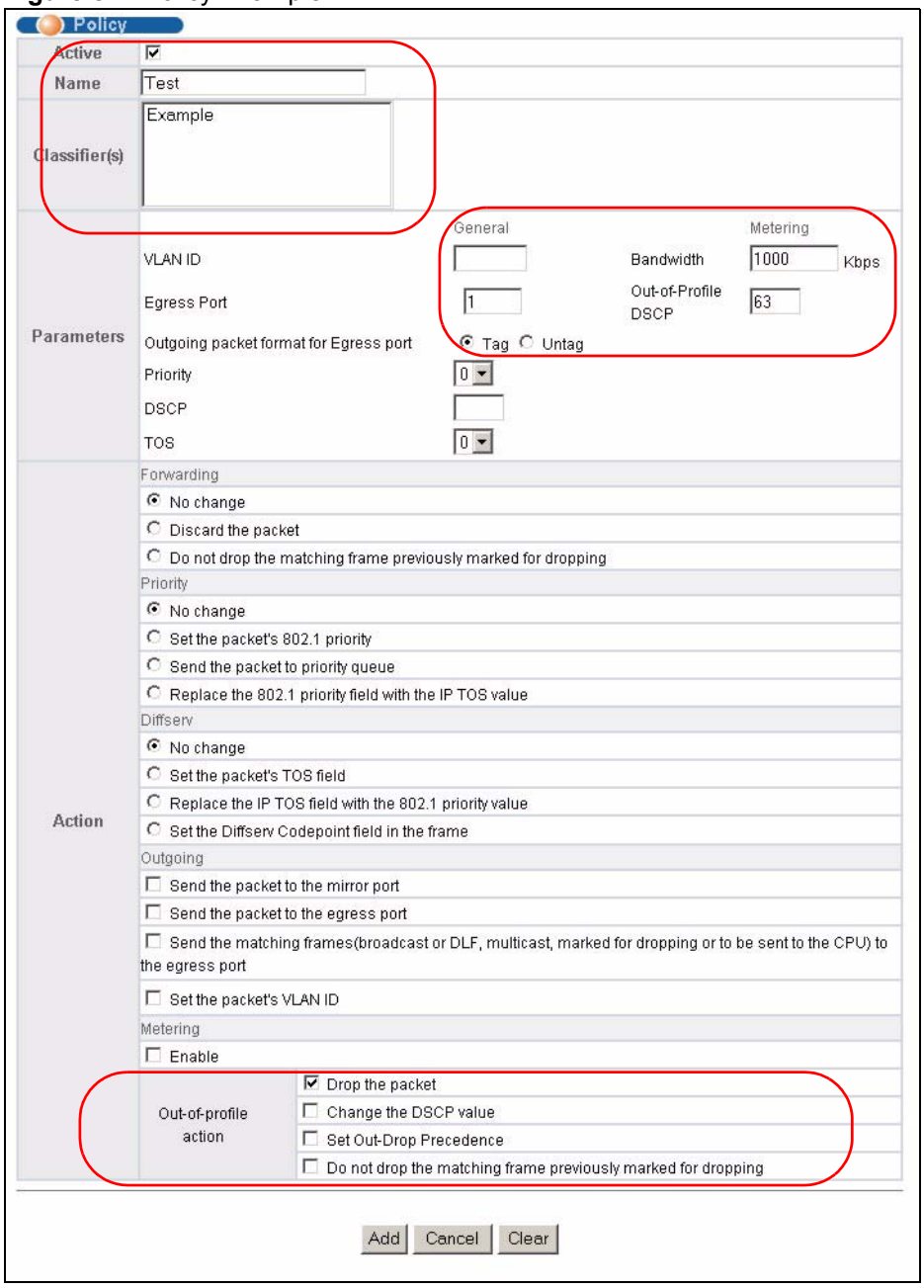
Table 50 Policy: Summary Table

LABEL	DESCRIPTION
Index	This field displays the policy index number. Click an index number to edit the policy.
Active	This field displays **Yes** when policy is activated and **No** when is it deactivated.
Name	This field displays the name you have assigned to this policy.
Classifier(s)	This field displays the name(s) of the classifier to which this policy applies.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

19.4 Policy Example

The figure below shows an example **Policy** screen where you configure a policy to limit bandwidth and discard out-of-profile traffic on a traffic flow classified using the **Example** classifier (refer to Section 18.4 on page 155).

Figure 81 Policy Example



20

Queuing Method

This chapter introduces the queuing methods supported.

20.1 Queuing Method Overview

Queuing is used to help solve performance degradation when there is network congestion. Use the **Queuing Method** screen to configure queuing algorithms for outgoing traffic. See also **Priority Queue Assignment** in **Switch Setup** and **802.1p Priority** in **Port Setup** for related information.

Queuing algorithms allow switches to maintain separate queues for packets from each individual source or flow and prevent a source from monopolizing the bandwidth.

20.1.1 Strictly Priority

Strictly Priority (SP) services queues based on priority only. As traffic comes into the Switch, traffic on the highest priority queue, Q7 is transmitted first. When that queue empties, traffic on the next highest-priority queue, Q6 is transmitted until Q6 empties, and then traffic is transmitted on Q5 and so on. If higher priority queues never empty, then traffic on lower priority queues never gets sent. SP does not automatically adapt to changing network requirements.

20.1.2 Weighted Fair Queuing

Weighted Fair Queuing is used to guarantee each queue's minimum bandwidth based on its bandwidth weight (portion) (the number you configure in the Weight field - see Figure 18 1) when there is traffic congestion. WFQ is activated only when a port has more traffic than it can handle. Queues with larger weights get more guaranteed bandwidth than queues with smaller weights. This queuing mechanism is highly efficient in that it divides any available bandwidth across the different traffic queues. By default, the weight for Q0 is 1, for Q1 is 2, for Q2 is 3, and so on. Guaranteed bandwidth is calculated as follows:

$$\frac{\text{Queue Weight}}{\text{Total Queue Weight}} \times \text{Port Speed}$$

For example, using the default setting, Q0 on Port 1 gets a guaranteed bandwidth of:

$$\frac{1}{1+2+3+4+5+6+7+8} \times 100\ \text{Mbps} = 3\ \text{Mbps}$$

20.1.3 Weighted Round Robin Scheduling (WRR)

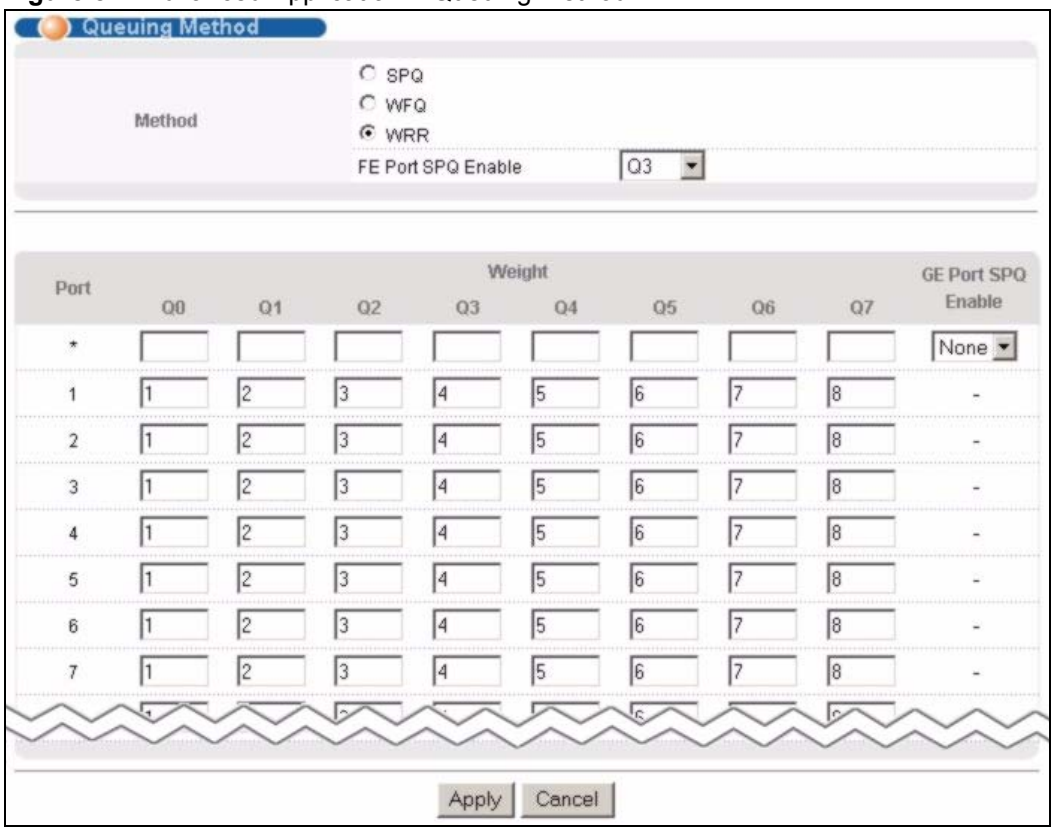
Round Robin Scheduling services queues on a rotating basis and is activated only when a port has more traffic than it can handle. A queue is a given an amount of bandwidth irrespective of the incoming traffic on that port. This queue then moves to the back of the list. The next queue is given an equal amount of bandwidth, and then moves to the end of the list; and so on, depending on the number of queues being used. This works in a looping fashion until a queue is empty.

Weighted Round Robin Scheduling (WRR) uses the same algorithm as round robin scheduling, but services queues based on their priority and queue weight (the number you configure in the queue **Weight** field) rather than a fixed amount of bandwidth. WRR is activated only when a port has more traffic than it can handle. Queues with larger weights get more service than queues with smaller weights. This queuing mechanism is highly efficient in that it divides any available bandwidth across the different traffic queues and returns to queues that have not yet emptied.

20.2 Configuring Queuing

Click **Advanced Application** > **Queuing Method** in the navigation panel.

Figure 82 Advanced Application > Queuing Method



The following table describes the labels in this screen.

Table 51 Advanced Application > Queuing Method

LABEL	DESCRIPTION
Method	Select **SPQ (Strictly Priority Queuing), WFQ (Weighted Fair Queuing) or WRR (Weighted Round Robin)**. Strictly Priority services queues based on priority only. When the highest priority queue empties, traffic on the next highest-priority queue begins. Q7 has the highest priority and Q0 the lowest. Weighted Fair Queuing is used to guarantee each queue's minimum bandwidth based on their bandwidth portion (weight) (the number you configure in the **Weight** field). Queues with larger weights get more guaranteed bandwidth than queues with smaller weights. Weighted Round Robin Scheduling services queues on a rotating basis based on their queue weight (the number you configure in the queue **Weight** field). Queues with larger weights get more service than queues with smaller weights.
FE Port SPQ Enable	This field is applicable only when you select **WFQ** or **WRR**. Select a queue (**Q0** to **Q7**) to have the Switch use **Strictly Priority** to service the subsequent queue(s) after and including the specified queue for the 10/100 Mbps Ethernet ports. For example, if you select **Q5**, the Switch services traffic on **Q5**, **Q6** and **Q7** using **Strictly Priority**. Select **None** to always use **WFQ or WRR** for the 10/100 Mbps Ethernet ports.
Port	This label shows the port you are configuring.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Weight	When you select **WFQ** or **WRR** enter the queue weight here. Bandwidth is divided across the different traffic queues according to their weights.
GE Port SPQ Enable	This field is applicable only when you select **WFQ** or **WRR**. Select a queue (**Q0** to **Q7**) to have the Switch use **Strictly Priority** to service the subsequent queue(s) after and including the specified queue for the gigabit ports. For example, if you select **Q5**, the Switch services traffic on **Q5**, **Q6** and **Q7** using **Strictly Priority**. Select **None** to always use **WFQ or WRR** for the gigabit ports.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

21

VLAN Stacking

This chapter shows you how to configure VLAN stacking on your Switch. See the chapter on VLANs for more background information on Virtual LAN

21.1 VLAN Stacking Overview

A service provider can use VLAN stacking to allow it to distinguish multiple customers VLANs, even those with the same (customer-assigned) VLAN ID, within its network.

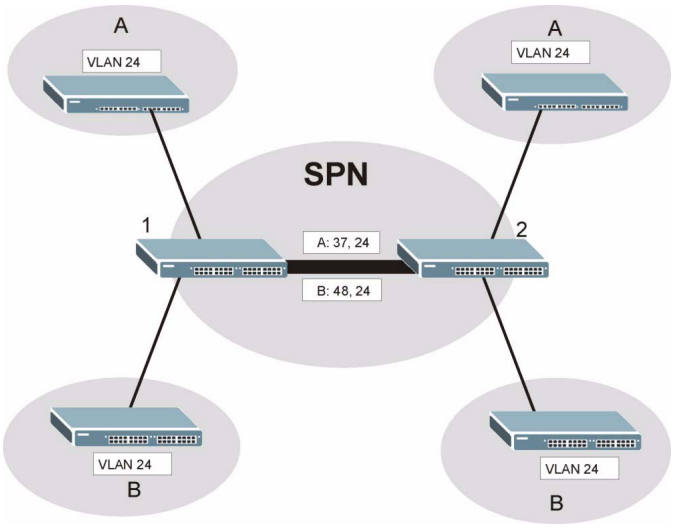
Use VLAN stacking to add an outer VLAN tag to the inner IEEE 802.1Q tagged frames that enter the network. By tagging the tagged frames ("double-tagged" frames), the service provider can manage up to 4,094 VLAN groups with each group containing up to 4,094 customer VLANs. This allows a service provider to provide different service, based on specific VLANs, for many different customers.

A service provider's customers may require a range of VLANs to handle multiple applications. A service provider's customers can assign their own inner VLAN tags on ports for these applications. The service provider can assign an outer VLAN tag for each customer. Therefore, there is no VLAN tag overlap among customers, so traffic from different customers is kept separate.

21.1.1 VLAN Stacking Example

In the following example figure, both **A** and **B** are Service Provider's Network (SPN) customers with VPN tunnels between their head offices and branch offices respectively. Both have an identical VLAN tag for their VLAN group. The service provider can separate these two VLANs within its network by adding tag 37 to distinguish customer **A** and tag 48 to distinguish customer **B** at edge device **1** and then stripping those tags at edge device **2** as the data frames leave the network.

Figure 83 VLAN Stacking Example



21.2 VLAN Stacking Port Roles

Each port can have three VLAN stacking “roles”, **Normal**, **Access Port** and **Tunnel** (the latter is for Gigabit ports only).

- Select **Normal** for “regular” (non-VLAN stacking) IEEE 802.1Q frame switching.
- Select **Access Port** for ingress ports on the service provider's edge devices (**1** and **2** in the VLAN stacking example figure). The incoming frame is treated as "untagged", so a second VLAN tag (outer VLAN tag) can be added.

Static VLAN **Tx Tagging** MUST be disabled on a port where you choose **Normal** or **Access Port**.

- Select **Tunnel Port** (available for Gigabit ports only) for egress ports at the edge of the service provider's network. All VLANs belonging to a customer can be aggregated into a single service provider's VLAN (using the outer VLAN tag defined by SP VID).

Static VLAN **Tx Tagging** MUST be enabled on a port where you choose **Tunnel Port**.

21.3 VLAN Tag Format

A VLAN tag (service provider VLAN stacking or customer IEEE 802.1Q) consists of the following three fields.

Table 52 VLAN Tag Format

Type	Priority	VID

Type is a standard Ethernet type code identifying the frame and indicates that whether the frame carries IEEE 802.1Q tag information. **SP TPID** (Service Provider Tag Protocol Identifier) is the service provider VLAN stacking tag type. Many vendors use 0x8100 or 0x9100.

TPID (Tag Protocol Identifier) is the customer IEEE 802.1Q tag.

- If the VLAN stacking port role is **Access Port**, then the Switch adds the **SP TPID** tag to all incoming frames on the service provider's edge devices (1 and 2 in the VLAN stacking example figure).
- If the VLAN stacking port role is **Tunnel Port**, then the Switch only adds the **SP TPID** tag to all incoming frames on the service provider's edge devices (1 and 2 in the VLAN stacking example figure) that have an **SP TPID** different to the one configured on the Switch. (If an incoming frame's **SP TPID** is the same as the one configured on the Switch, then the Switch will not add the tag.)

Priority refers to the IEEE 802.1p standard that allows the service provider to prioritize traffic based on the class of service (CoS) the customer has paid for.

- On the Switch, configure priority level of inner IEEE 802.1Q tag in the **Port Setup** screen.
- "0" is the lowest priority level and "7" is the highest.

VID is the VLAN ID. **SP VID** is the VID for the second (service provider's) VLAN tag.

21.3.1 Frame Format

The frame format for an untagged Ethernet frame, a single-tagged 802.1Q frame (customer) and a "double-tagged" 802.1Q frame (service provider) is shown next.

Configure the fields as highlighted in the Switch **VLAN Stacking** screen.

Table 53 Single and Double Tagged 802.11Q Frame Format

						DA	SA	Len/ Etype	Data	FCS	Untagged Ethernet frame
			DA	SA	**TPID**	**Priority**	**VID**	Len/ Etype	Data	FCS	IEEE 802.1Q customer tagged frame
DA	SA	**SPTPID**	**Priority**	**VID**	**TPID**	**Priority**	**VID**	Len/ Etype	Data	FCS	Double-tagged frame

Table 54 802.1Q Frame

DA	Destination Address	Priority	802.1p Priority
SA	Source Address	Len/ Etype	Length and type of Ethernet frame

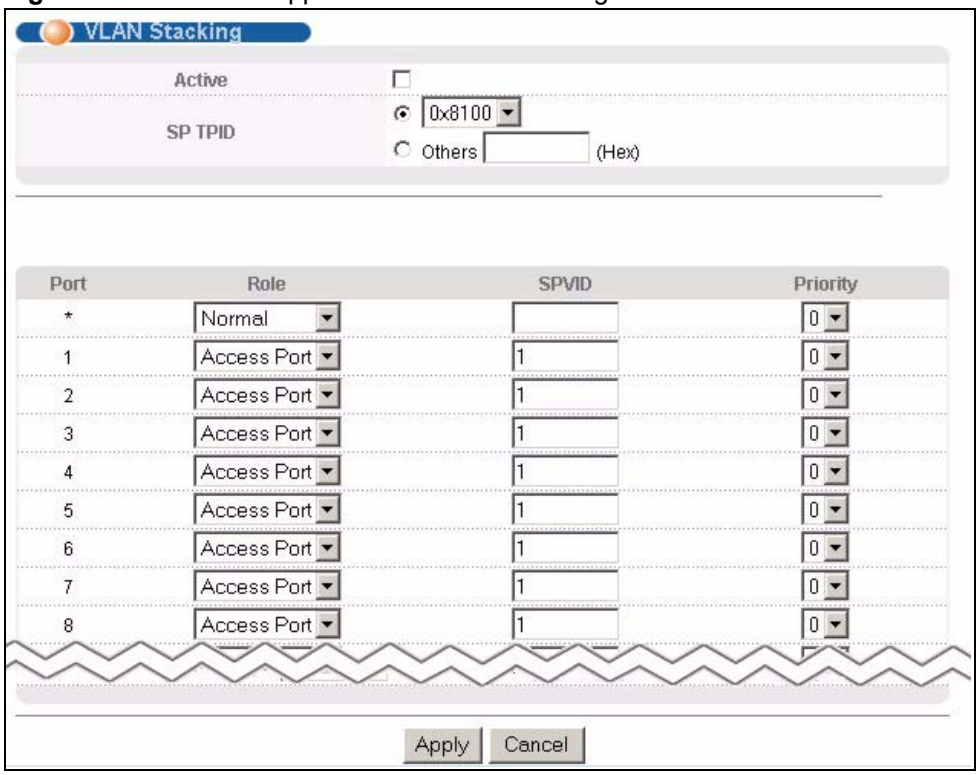
Table 54 802.1Q Frame

(SP)TPID	(Service Provider) Tag Protocol IDentifier	Data	Frame data
VID	VLAN ID	FCS	Frame Check Sequence

21.4 Configuring VLAN Stacking

Click **Advanced Applications > VLAN Stacking** to display the screen as shown.

Figure 84 Advanced Application > VLAN Stacking



The following table describes the labels in this screen.

Table 55 Advanced Application > VLAN Stacking

LABEL	DESCRIPTION
Active	Select this to enable VLAN stacking on the Switch.
SP TPID	**SP TPID** is a standard Ethernet type code identifying the frame and indicates whether the frame carries IEEE 802.1Q tag information. Choose **0x8100** or **0x9100** from the drop-down list box or select **Others** and then enter a four-digit hexadecimal number from 0x0000 to 0xFFFF. 0x denotes a hexadecimal number. It does not have to be typed in the **Others** text field.
Port	The port number identifies the port you are configuring.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.

Table 55 Advanced Application > VLAN Stacking (continued)

LABEL	DESCRIPTION
Role	Select **Normal** to have the Switch ignore frames received (or transmitted) on this port with VLAN stacking tags. Anything you configure in **SPVID** and **Priority** are ignored. Select **Access Port** to have the Switch add the **SP TPID** tag to all incoming frames received on this port. Select **Access Port** for ingress ports at the edge of the service provider's network. Select **Tunnel Port** (available for Gigabit ports only) for egress ports at the edge of the service provider's network. In order to support VLAN stacking on a port, the port must be able to allow frames of 1526 Bytes (1522 Bytes + 4 Bytes for the second tag) to pass through it.
SPVID	**SPVID** is the service provider’s VLAN ID (the outer VLAN tag). Enter the service provider ID (from 1 to 4094) for frames received on this port. See Chapter 8 on page 87 for more background information on VLAN ID.
Priority	On the Switch, configure priority level of inner IEEE 802.1Q tag in the **Port Setup** screen. "0" is the lowest priority level and "7" is the highest.
Apply	Click **Apply** to save your changes to the Switch’s run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

22 Multicast

This chapter shows you how to configure various multicast features.

22.1 Multicast Overview

Traditionally, IP packets are transmitted in one of either two ways - Unicast (1 sender to 1 recipient) or Broadcast (1 sender to everybody on the network). Multicast delivers IP packets to just a group of hosts on the network.

IGMP (Internet Group Management Protocol) is a network-layer protocol used to establish membership in a multicast group - it is not used to carry user data. Refer to RFC 1112, RFC 2236 and RFC 3376 for information on IGMP versions 1, 2 and 3 respectively.

22.1.1 IP Multicast Addresses

In IPv4, a multicast address allows a device to send packets to a specific group of hosts (multicast group) in a different subnetwork. A multicast IP address represents a traffic receiving group, not individual receiving devices. IP addresses in the Class D range (224.0.0.0 to 239.255.255.255) are used for IP multicasting. Certain IP multicast numbers are reserved by IANA for special purposes (see the IANA web site for more information).

22.1.2 IGMP Filtering

With the IGMP filtering feature, you can control which IGMP groups a subscriber on a port can join. This allows you to control the distribution of multicast services (such as content information distribution) based on service plans and types of subscription.

You can set the Switch to filter the multicast group join reports on a per-port basis by configuring an IGMP filtering profile and associating the profile to a port.

22.1.3 IGMP Snooping

The Switch can passively snoop on IGMP packets transferred between IP multicast routers/ switches and IP multicast hosts to learn the IP multicast group membership. It checks IGMP packets passing through it, picks out the group registration information, and configures multicasting accordingly. IGMP snooping allows the Switch to learn multicast groups without you having to manually configure them.

The Switch forwards multicast traffic destined for multicast groups (that it has learned from IGMP snooping or that you have manually configured) to ports that are members of that group. IGMP snooping generates no additional network traffic, allowing you to significantly reduce multicast traffic passing through your Switch.

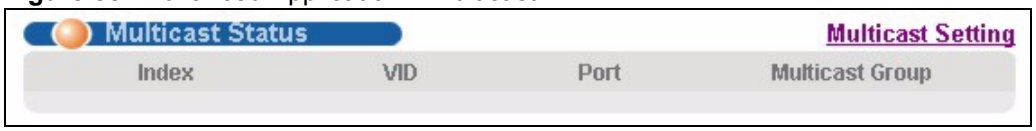
22.1.4 IGMP Snooping and VLANs

The Switch can perform IGMP snooping on up to 16 VLANs. You can configure the Switch to automatically learn multicast group membership of any VLANs. The Switch then performs IGMP snooping on the first 16 VLANs that send IGMP packets. This is referred to as auto mode. Alternatively, you can specify the VLANs that IGMP snooping should be performed on. This is referred to as fixed mode. In fixed mode the Switch does not learn multicast group membership of any VLANs other than those explicitly added as an IGMP snooping VLAN.

22.2 Multicast Status

Click **Advanced Applications > Multicast** to display the screen as shown. This screen shows the multicast group information. See Section 22.1 on page 173 for more information on multicasting.

Figure 85 Advanced Application > Multicast



The following table describes the labels in this screen.

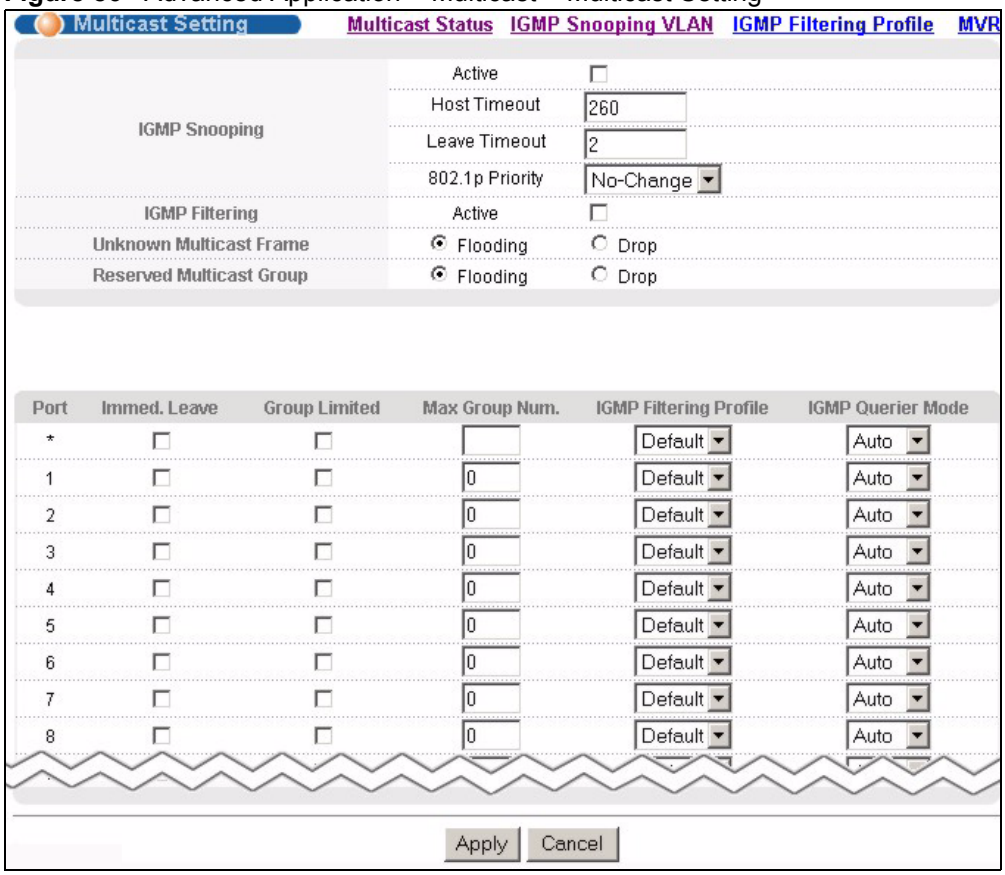
Table 56 Multicast Status

LABEL	DESCRIPTION
Index	This is the index number of the entry.
VID	This field displays the multicast VLAN ID.
Port	This field displays the port number that belongs to the multicast group.
Multicast Group	This field displays IP multicast group addresses.

22.3 Multicast Setting

Click **Advanced Applications > Multicast > Multicast Setting** link to display the screen as shown. See Section 22.1 on page 173 for more information on multicasting.

Figure 86 Advanced Application > Multicast > Multicast Setting



The following table describes the labels in this screen.

Table 57 Advanced Application > Multicast > Multicast Setting

LABEL	DESCRIPTION
IGMP Snooping	Use these settings to configure IGMP Snooping.
Active	Select **Active** to enable IGMP Snooping to forward group multicast traffic only to ports that are members of that group.
Host Timeout	Specify the time (from 1 to 16,711,450) in seconds that elapses before the Switch removes an IGMP group membership entry if it does not receive report messages from the port.
Leave Timeout	Enter an IGMP leave timeout value (from 1 to 16,711,450) in seconds. This defines how many seconds the Switch waits for an IGMP report before removing an IGMP snooping membership entry when an IGMP leave message is received from a host.
802.1p Priority	Select a priority level (0-7) to which the Switch changes the priority in outgoing IGMP control packets. Otherwise, select **No-Change** to not replace the priority.
IGMP Filtering	Select **Active** to enable IGMP filtering to control which IGMP groups a subscriber on a port can join. Note: If you enable IGMP filtering, you must create and assign IGMP filtering profiles for the ports that you want to allow to join multicast groups.
Unknown Multicast Frame	Specify the action to perform when the Switch receives an unknown multicast frame. Select **Drop** to discard the frame(s). Select **Flooding** to send the frame(s) to all ports.

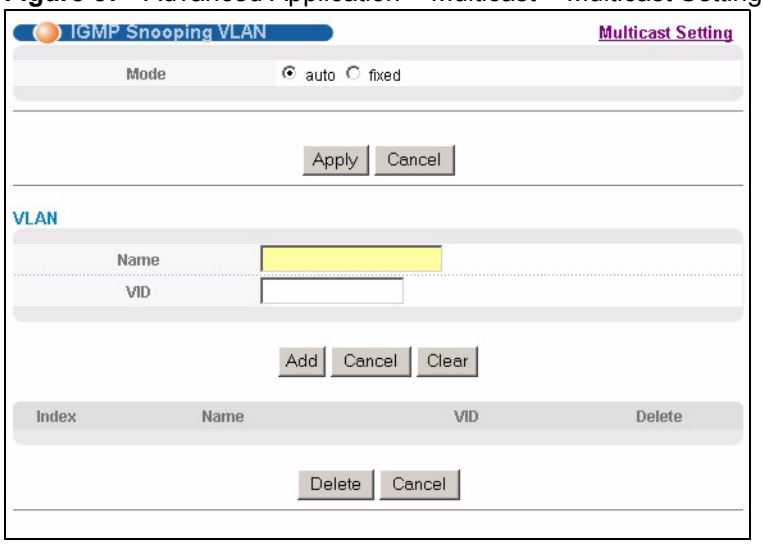
Table 57 Advanced Application > Multicast > Multicast Setting (continued)

LABEL	DESCRIPTION
Reserved Multicast Group	Multicast addresses (224.0.0.0 to 224.0.0.255) are reserved for the local scope. For examples, 224.0.0.1 is for all hosts in this subnet, 224.0.0.2 is for all multicast routers in this subnet, etc. A router will not forward a packet with the destination IP address within this range. See the IANA web site for more information. Specify the action to perform when the Switch receives a frame with a reserved multicast address. Select **Drop** to discard the frame(s). Select **Flooding** to send the frame(s) to all ports.
Port	This field displays the port number.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Immed. Leave	Select this option to set the Switch to remove this port from the multicast tree when an IGMP version 2 leave message is received on this port. Select this option if there is only one host connected to this port.
Group Limited	Select this option to limit the number of multicast groups this port is allowed to join.
Max Group Num.	Enter the number of multicast groups this port is allowed to join. Once a port is registered in the specified number of multicast groups, any new IGMP join report frame(s) is dropped on this port.
IGMP Filtering Profile	Select the name of the IGMP filtering profile to use for this port. Otherwise, select **Default** to prohibit the port from joining any multicast group. You can create IGMP filtering profiles in the **Multicast** > **Multicast Setting** > **IGMP Filtering Profile** screen.
IGMP Querier Mode	The Switch treats an IGMP query port as being connected to an IGMP multicast router (or server). The Switch forwards IGMP join or leave packets to an IGMP query port. Select **Auto** to have the Switch use the port as an IGMP query port if the port receives IGMP query packets. Select **Fixed** to have the Switch always use the port as an IGMP query port. Select this when you connect an IGMP multicast server to the port. Select **Edge** to stop the Switch from using the port as an IGMP query port. The Switch will not keep any record of an IGMP router being connected to this port. The Switch does not forward IGMP join or leave packets to this port.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

22.4 IGMP Snooping VLAN

Click **Advanced Applications > Multicast** in the navigation panel. Click the **Multicast Setting** link and then the **IGMP Snooping VLAN** link to display the screen as shown. See Section 22.1.4 on page 174 for more information on IGMP Snooping VLAN.

Figure 87 Advanced Application > Multicast > Multicast Setting > IGMP Snooping VLAN



The following table describes the labels in this screen.

Table 58 Advanced Application > Multicast > Multicast Setting > IGMP Snooping VLAN

LABEL	DESCRIPTION
Mode	Select **auto** to have the Switch learn multicast group membership information of any VLANs automatically. Select **fixed** to have the Switch only learn multicast group membership information of the VLAN(s) that you specify below. In either **auto** or **fixed** mode, the Switch can learn up to 16 VLANs (including up to three VLANs you configured in the **MVR** screen). For example, if you have configured one multicast VLAN in the **MVR** screen, you can only specify up to 15 VLANs in this screen. The Switch drops any IGMP control messages which do not belong to these 16 VLANs. Note: You must also enable IGMP snooping in the **Multicast Setting** screen first.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
VLAN	Use this section of the screen to add VLANs upon which the Switch is to perform IGMP snooping.
Name	Enter the descriptive name of the VLAN for identification purposes.
VID	Enter the ID of a static VLAN; the valid range is between 1 and 4094. Note: You cannot configure the same VLAN ID as in the **MVR** screen.
Add	Click **Add** to insert the entry in the summary table below and save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to reset the fields to your previous configuration.
Clear	Click this to clear the fields.

Table 58 Advanced Application > Multicast > Multicast Setting > IGMP Snooping VLAN

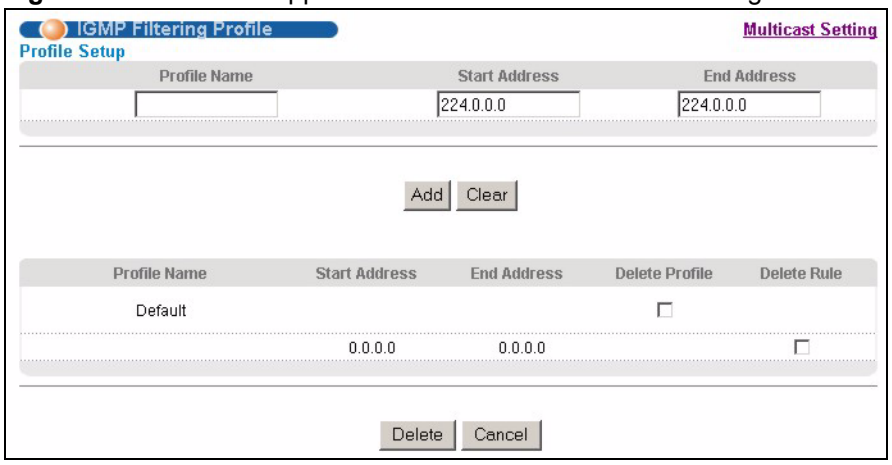
LABEL	DESCRIPTION
Index	This is the number of the IGMP snooping VLAN entry in the table.
Name	This field displays the descriptive name for this VLAN group.
VID	This field displays the ID number of the VLAN group.
Delete	Check the rule(s) that you want to remove in the **Delete** column, then click the **Delete** button.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

22.5 IGMP Filtering Profile

An IGMP filtering profile specifies a range of multicast groups that clients connected to the Switch are able to join. A profile contains a range of multicast IP addresses which you want clients to be able to join. Profiles are assigned to ports (in the **Multicast Setting** screen). Clients connected to those ports are then able to join the multicast groups specified in the profile. Each port can be assigned a single profile. A profile can be assigned to multiple ports.

Click **Advanced Applications** > **Multicast** > **Multicast Setting** > **IGMP Filtering Profile** link to display the screen as shown.

Figure 88 Advanced Application > Multicast > Multicast Setting > IGMP Filtering Profile



The following table describes the labels in this screen.

Table 59 Advanced Application > Multicast > Multicast Setting > IGMP Filtering Profile

LABEL	DESCRIPTION
Profile Name	Enter a descriptive name for the profile for identification purposes. To configure additional rule(s) for a profile that you have already added, enter the profile name and specify a different IP multicast address range.
Start Address	Type the starting multicast IP address for a range of multicast IP addresses that you want to belong to the IGMP filter profile.
End Address	Type the ending multicast IP address for a range of IP addresses that you want to belong to the IGMP filter profile. If you want to add a single multicast IP address, enter it in both the **Start Address** and **End Address** fields.

Table 59 Advanced Application > Multicast > Multicast Setting > IGMP Filtering Profile

LABEL	DESCRIPTION
Add	Click **Add** to save the profile to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Clear	Click **Clear** to clear the fields to the factory defaults.
Profile Name	This field displays the descriptive name of the profile.
Start Address	This field displays the start of the multicast address range.
End Address	This field displays the end of the multicast address range.
Delete	To delete the profile(s) and all the accompanying rules, select the profile(s) that you want to remove in the **Delete Profile** column, then click the **Delete** button. To delete a rule(s) from a profile, select the rule(s) that you want to remove in the **Delete Rule** column, then click the **Delete** button.
Cancel	Click **Cancel** to clear the **Delete Profile**/**Delete Rule** check boxes.

22.6 MVR Overview

Multicast VLAN Registration (MVR) is designed for applications (such as Media-on-Demand (MoD)) that use multicast traffic across an Ethernet ring-based service provider network.

MVR allows one single multicast VLAN to be shared among different subscriber VLANs on the network. While isolated in different subscriber VLANs, connected devices can subscribe to and unsubscribe from the multicast stream in the multicast VLAN. This improves bandwidth utilization with reduced multicast traffic in the subscriber VLANs and simplifies multicast group management.

MVR only responds to IGMP join and leave control messages from multicast groups that are configured under MVR. Join and leave reports from other multicast groups are managed by IGMP snooping.

The following figure shows a network example. The subscriber VLAN (**1**, **2** and **3**) information is hidden from the streaming media server, **S**. In addition, the multicast VLAN information is only visible to the Switch and **S**.

Figure 89 MVR Network Example



22.6.1 Types of MVR Ports

In MVR, a source port is a port on the Switch that can send and receive multicast traffic in a multicast VLAN while a receiver port can only receive multicast traffic. Once configured, the Switch maintains a forwarding table that matches the multicast stream to the associated multicast group.

22.6.2 MVR Modes

You can set your Switch to operate in either dynamic or compatible mode.

In dynamic mode, the Switch sends IGMP leave and join reports to the other multicast devices (such as multicast routers or servers) in the multicast VLAN. This allows the multicast devices to update the multicast forwarding table to forward or not forward multicast traffic to the receiver ports.

In compatible mode, the Switch does not send any IGMP reports. In this case, you must manually configure the forwarding settings on the multicast devices in the multicast VLAN.

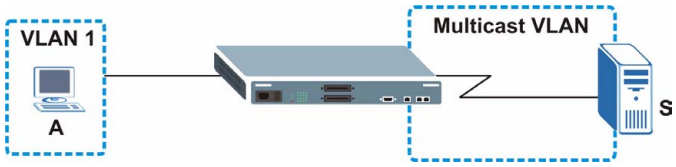
22.6.3 How MVR Works

The following figure shows a multicast television example where a subscriber device (such as a computer) in VLAN 1 receives multicast traffic from the streaming media server, **S**, via the Switch. Multiple subscriber devices can connect through a port configured as the receiver on the Switch.

When the subscriber selects a television channel, computer **A** sends an IGMP report to the Switch to join the appropriate multicast group. If the IGMP report matches one of the configured MVR multicast group addresses on the Switch, an entry is created in the forwarding table on the Switch. This maps the subscriber VLAN to the list of forwarding destinations for the specified multicast traffic.

When the subscriber changes the channel or turns off the computer, an IGMP leave message is sent to the Switch to leave the multicast group. The Switch sends a query to VLAN 1 on the receiver port (in this case, an uplink port on the Switch). If there is another subscriber device connected to this port in the same subscriber VLAN, the receiving port will still be on the list of forwarding destination for the multicast traffic. Otherwise, the Switch removes the receiver port from the forwarding table.

Figure 90 MVR Multicast Television Example



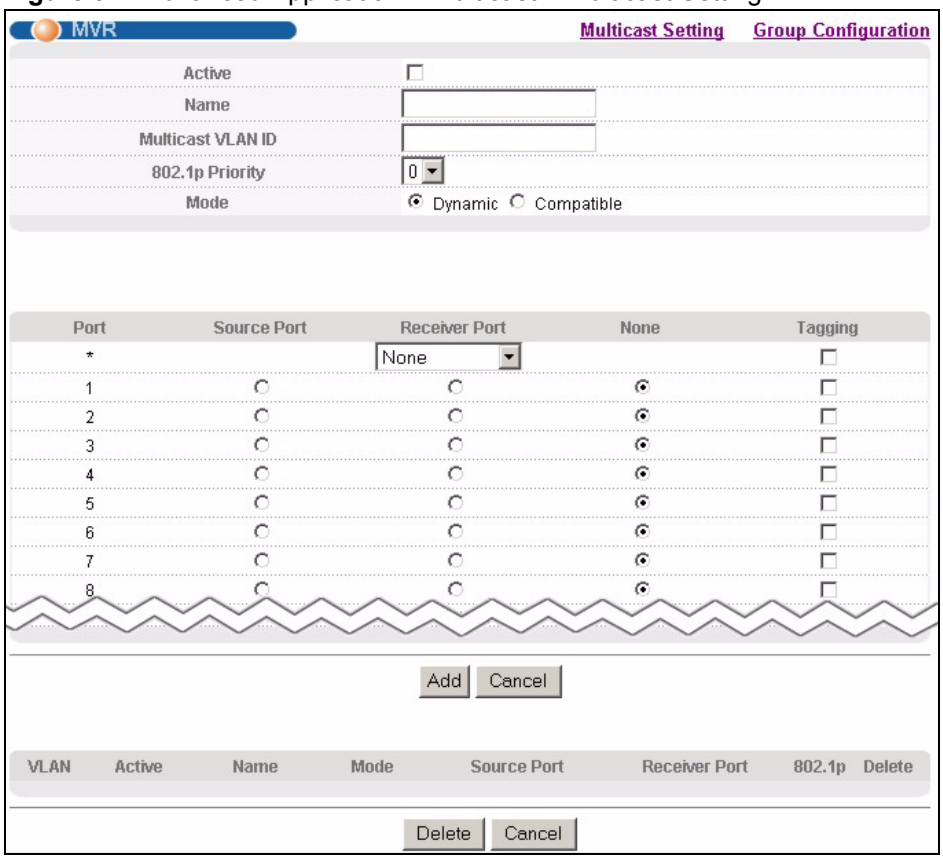
22.7 General MVR Configuration

Use the **MVR** screen to create multicast VLANs and select the receiver port(s) and a source port for each multicast VLAN. Click **Advanced Applications > Multicast** > **Multicast Setting > MVR** link to display the screen as shown next.

You can create up to three multicast VLANs and up to 256 multicast rules on the Switch.

Your Switch automatically creates a static VLAN (with the same VID) when you create a multicast VLAN in this screen.

Figure 91 Advanced Application > Multicast > Multicast Setting > MVR



The following table describes the related labels in this screen.

Table 60 Advanced Application > Multicast > Multicast Setting > MVR

LABEL	DESCRIPTION
Active	Select this check box to enable MVR to allow one single multicast VLAN to be shared among different subscriber VLANs on the network.
Name	Enter a descriptive name (up to 32 printable ASCII characters) for identification purposes.
Multicast VLAN ID	Enter the VLAN ID (1 to 4094) of the multicast VLAN.
802.1p Priority	Select a priority level (0-7) with which the Switch replaces the priority in outgoing IGMP control packets (belonging to this multicast VLAN).
Mode	Specify the MVR mode on the Switch. Choices are **Dynamic** and **Compatible**. Select **Dynamic** to send IGMP reports to all MVR source ports in the multicast VLAN. Select **Compatible** to set the Switch not to send IGMP reports.
Port	This field displays the port number on the Switch.

Table 60 Advanced Application > Multicast > Multicast Setting > MVR (continued)

LABEL	DESCRIPTION
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Source Port	Select this option to set this port as the MVR source port that sends and receives multicast traffic. All source ports must belong to a single multicast VLAN.
Receiver Port	Select this option to set this port as a receiver port that only receives multicast traffic.
None	Select this option to set the port not to participate in MVR. No MVR multicast traffic is sent or received on this port.
Tagging	Select this checkbox if you want the port to tag the VLAN ID in all outgoing frames transmitted.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
VLAN	This field displays the multicast VLAN ID.
Active	This field displays whether the multicast group is enabled or not.
Name	This field displays the descriptive name for this setting.
Mode	This field displays the MVR mode.
Source Port	This field displays the source port number(s).
Receiver Port	This field displays the receiver port number(s).
802.1p	This field displays the priority level.
Delete	To delete a multicast VLAN(s), select the rule(s) that you want to remove in the **Delete** column, then click the **Delete** button.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

22.8 MVR Group Configuration

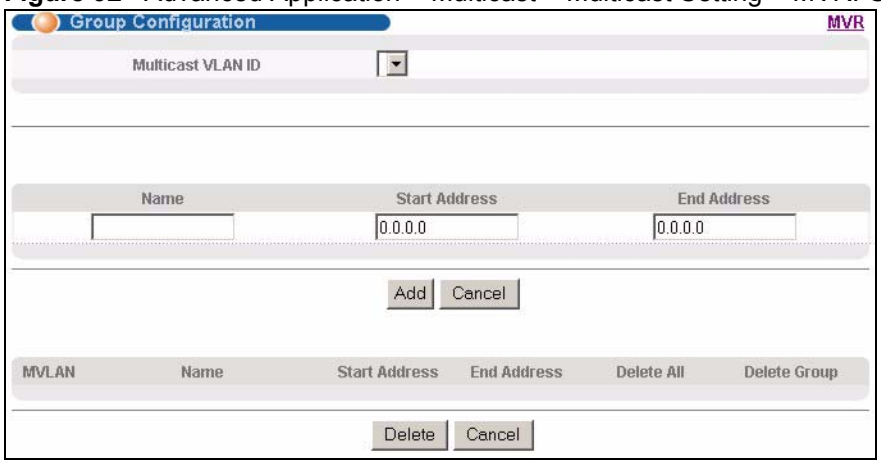
All source ports and receiver ports belonging to a multicast group can receive multicast data sent to this multicast group.

Configure MVR IP multicast group address(es) in the **Group Configuration** screen. Click **Group Configuration** in the **MVR** screen.



A port can belong to more than one multicast VLAN. However, IP multicast group addresses in different multicast VLANs cannot overlap.

Figure 92 Advanced Application > Multicast > Multicast Setting > MVR: Group Configuration



The following table describes the labels in this screen.

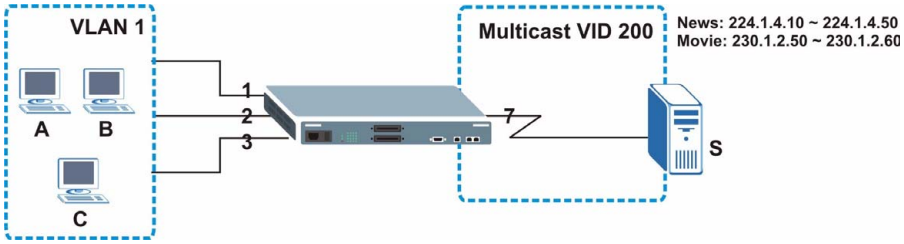
Table 61 Advanced Application > Multicast > Multicast Setting > MVR: Group Configuration

LABEL	DESCRIPTION
Multicast VLAN ID	Select a multicast VLAN ID (that you configured in the **MVR** screen) from the drop-down list box.
Name	Enter a descriptive name for identification purposes.
Start Address	Enter the starting IP multicast address of the multicast group in dotted decimal notation. Refer to Section 22.1.1 on page 173 for more information on IP multicast addresses.
End Address	Enter the ending IP multicast address of the multicast group in dotted decimal notation. Enter the same IP address as the **Start Address** field if you want to configure only one IP address for a multicast group. Refer to Section 22.1.1 on page 173 for more information on IP multicast addresses.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
MVLAN	This field displays the multicast VLAN ID.
Name	This field displays the descriptive name for this setting.
Start Address	This field displays the starting IP address of the multicast group.
End Address	This field displays the ending IP address of the multicast group.
Delete	Select **Delete Group** and click **Delete** to remove the selected entry(ies) from the table.
Cancel	Select **Cancel** to clear the checkbox(es) in the table.

22.8.1 MVR Configuration Example

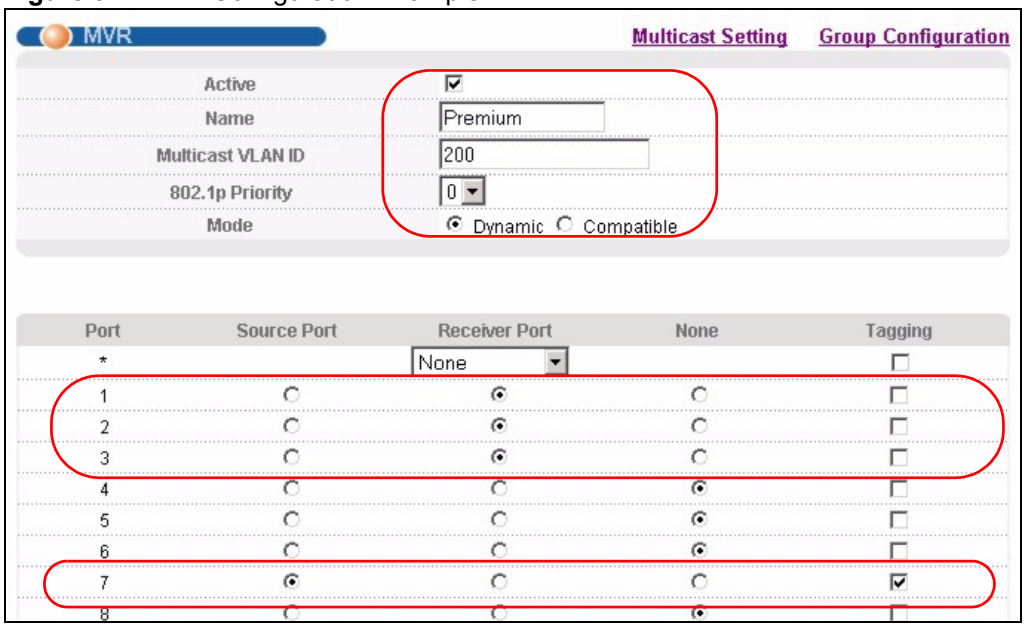
The following figure shows a network example where ports 1, 2 and 3 on the Switch belong to VLAN 1. In addition, port 7 belongs to the multicast group with VID 200 to receive multicast traffic (the **News** and **Movie** channels) from the remote streaming media server, **S**. Computers A, B and C in VLAN 1 are able to receive the traffic.

Figure 93 MVR Configuration Example



To configure the MVR settings on the Switch, create a multicast group in the **MVR** screen and set the receiver and source ports.

Figure 94 MVR Configuration Example



To set the Switch to forward the multicast group traffic to the subscribers, configure multicast group settings in the **Group Configuration** screen. The following figure shows an example where two multicast groups (**News** and **Movie**) are configured for the multicast VLAN 200.

Figure 95 MVR Group Configuration Example

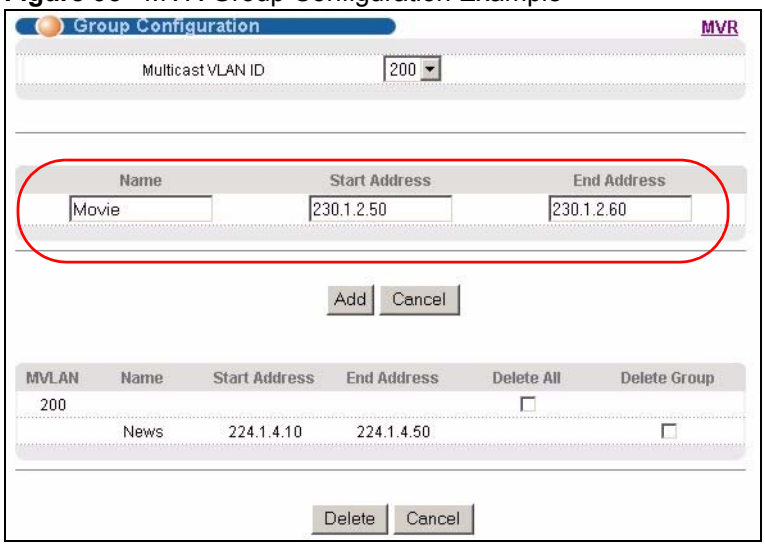
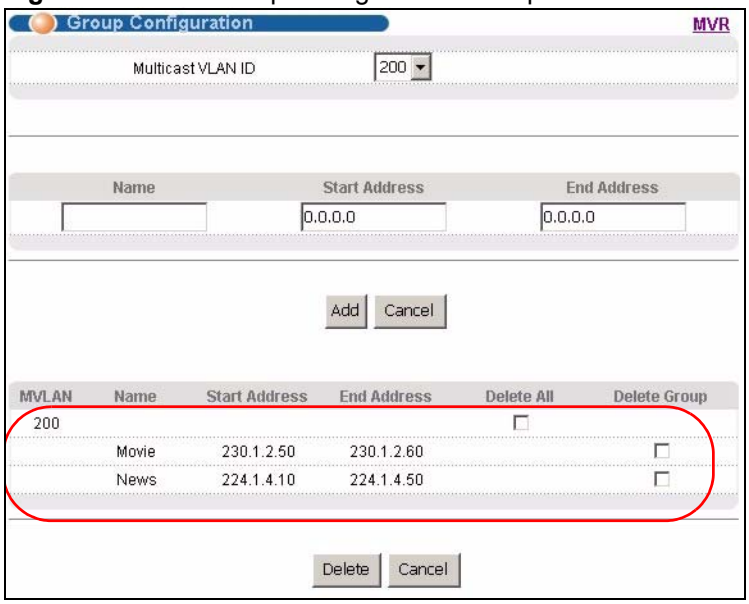


Figure 96 MVR Group Configuration Example



23

Authentication & Accounting

This chapter describes how to configure authentication and accounting settings on the Switch.

23.1 Authentication, Authorization and Accounting

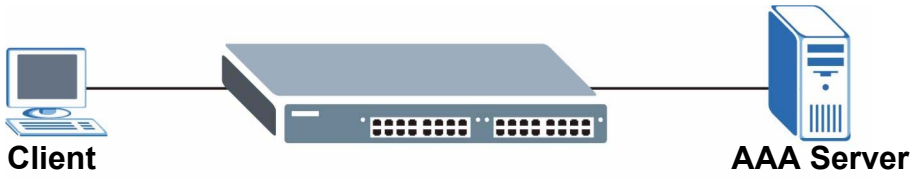
Authentication is the process of determining who a user is and validating access to the Switch. The Switch can authenticate users who try to log in based on user accounts configured on the Switch itself. The Switch can also use an external authentication server to authenticate a large number of users

Authorization is the process of determining what a user is allowed to do. Different user accounts may have higher or lower privilege levels associated with them. For example, user A may have the right to create new login accounts on the Switch but user B cannot. The Switch can authorize users based on user accounts configured on the Switch itself or it can use an external server to authorize a large number of users.

Accounting is the process of recording what a user is doing. The Switch can use an external server to track when users log in, log out, execute commands and so on. Accounting can also record system related actions such as boot up and shut down times of the Switch.

The external servers that perform authentication, authorization and accounting functions are known as AAA servers. The Switch supports RADIUS (Remote Authentication Dial-In User Service, see Section 23.1.2 on page 188) and TACACS+ (Terminal Access Controller Access-Control System Plus, see Section 23.1.2 on page 188) as external authentication, authorization and accounting servers.

Figure 97 AAA Server



23.1.1 Local User Accounts

By storing user profiles locally on the Switch, your Switch is able to authenticate and authorize users without interacting with a network AAA server. However, there is a limit on the number of users you may authenticate in this way (See Chapter 30 on page 247).

23.1.2 RADIUS and TACACS+

RADIUS and TACACS+ are security protocols used to authenticate users by means of an external server instead of (or in addition to) an internal device user database that is limited to the memory capacity of the device. In essence, RADIUS and TACACS+ authentication both allow you to validate an unlimited number of users from a central location.

The following table describes some key differences between RADIUS and TACACS+.

Table 62 RADIUS vs TACACS+

	RADIUS	TACACS+
Transport Protocol	UDP (User Datagram Protocol)	TCP (Transmission Control Protocol)
Encryption	Encrypts the password sent for authentication.	All communication between the client (the Switch) and the TACACS server is encrypted.

23.2 Authentication and Accounting Screens

To enable authentication, accounting or both on the Switch. First, configure your authentication server settings (RADIUS, TACACS+ or both) and then set up the authentication priority and accounting settings.

Click **Advanced Application** > **Auth and Acct** in the navigation panel to display the screen as shown.

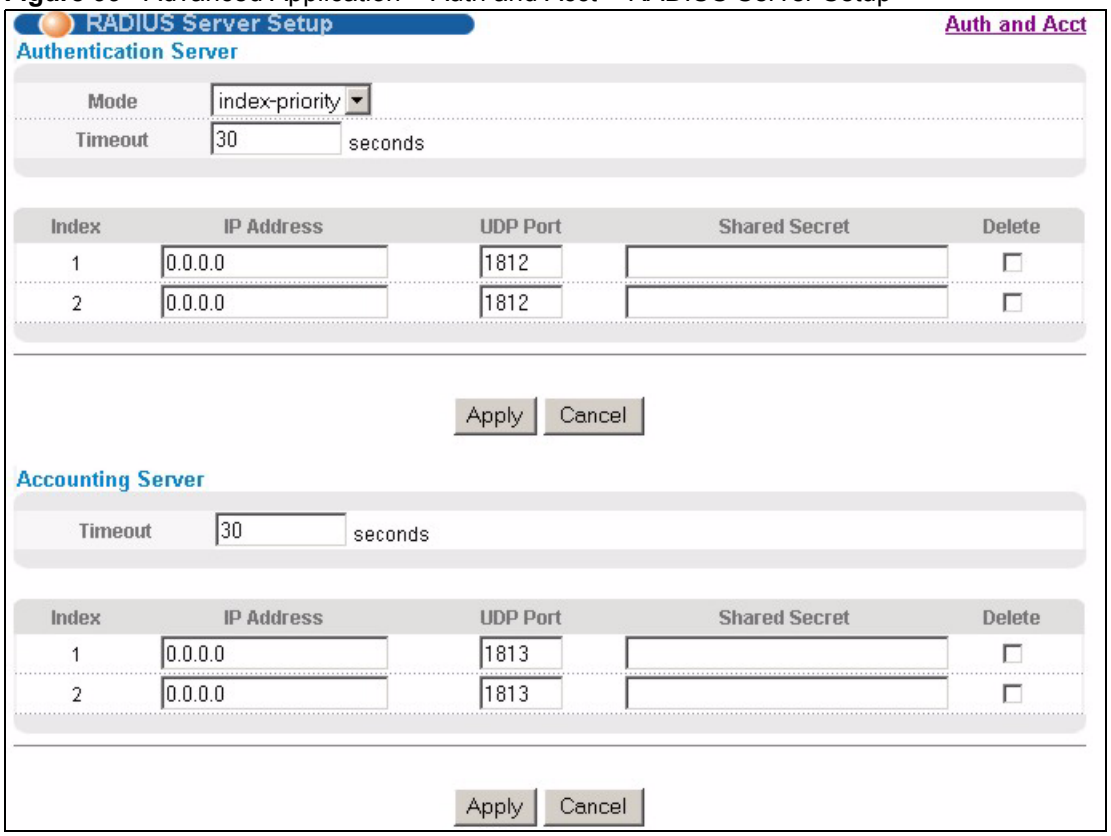
Figure 98 Advanced Application > Auth and Acct



23.2.1 RADIUS Server Setup

Use this screen to configure your RADIUS server settings. See Section 23.1.2 on page 188 for more information on RADIUS servers and Section 23.3 on page 196 for RADIUS attributes utilized by the authentication and accounting features on the Switch. Click on the **RADIUS Server Setup** link in the **Authentication and Accounting** screen to view the screen as shown.

Figure 99 Advanced Application > Auth and Acct > RADIUS Server Setup



The following table describes the labels in this screen.

Table 63 Advanced Application > Auth and Acct > RADIUS Server Setup

LABEL	DESCRIPTION
Authentication Server	Use this section to configure your RADIUS authentication settings.
Mode	This field is only valid if you configure multiple RADIUS servers. Select **index-priority** and the Switch tries to authenticate with the first configured RADIUS server, if the RADIUS server does not respond then the Switch tries to authenticate with the second RADIUS server. Select **round-robin** to alternate between the RADIUS servers that it sends authentication requests to.
Timeout	Specify the amount of time in seconds that the Switch waits for an authentication request response from the RADIUS server. If you are using **index-priority** for your authentication and you are using two RADIUS servers then the timeout value is divided between the two RADIUS servers. For example, if you set the timeout value to 30 seconds, then the Switch waits for a response from the first RADIUS server for 15 seconds and then tries the second RADIUS server.
Index	This is a read-only number representing a RADIUS server entry.
IP Address	Enter the IP address of an external RADIUS server in dotted decimal notation.
UDP Port	The default port of a RADIUS server for authentication is **1812**. You need not change this value unless your network administrator instructs you to do so.
Shared Secret	Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external RADIUS server and the Switch. This key is not sent over the network. This key must be the same on the external RADIUS server and the Switch.

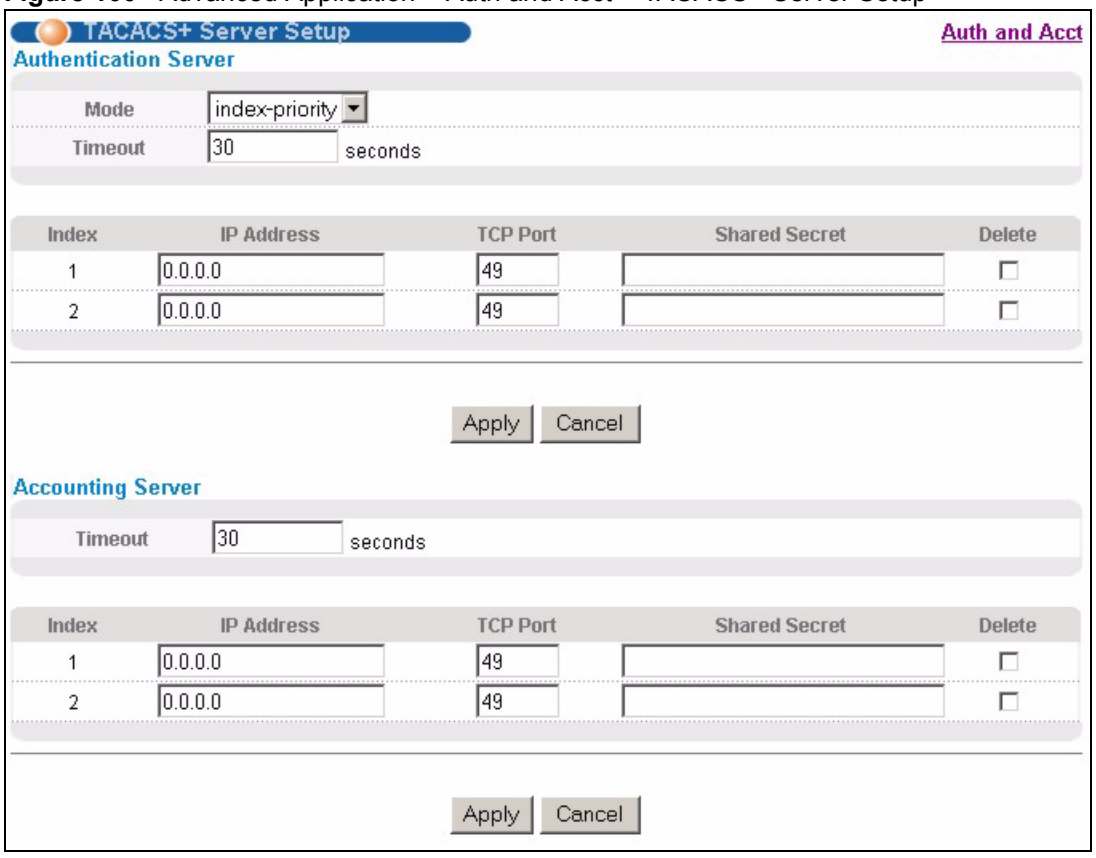
Table 63 Advanced Application > Auth and Acct > RADIUS Server Setup (continued)

LABEL	DESCRIPTION
Delete	Check this box if you want to remove an existing RADIUS server entry from the Switch. This entry is deleted when you click **Apply**.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Accounting Server	Use this section to configure your RADIUS accounting server settings.
Timeout	Specify the amount of time in seconds that the Switch waits for an accounting request response from the RADIUS accounting server.
Index	This is a read-only number representing a RADIUS accounting server entry.
IP Address	Enter the IP address of an external RADIUS accounting server in dotted decimal notation.
UDP Port	The default port of a RADIUS accounting server for accounting is **1813**. You need not change this value unless your network administrator instructs you to do so.
Shared Secret	Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external RADIUS accounting server and the Switch. This key is not sent over the network. This key must be the same on the external RADIUS accounting server and the Switch.
Delete	Check this box if you want to remove an existing RADIUS accounting server entry from the Switch. This entry is deleted when you click **Apply**.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

23.2.2 TACACS+ Server Setup

Use this screen to configure your TACACS+ server settings. See Section 23.1.2 on page 188 for more information on TACACS+ servers. Click on the **TACACS+ Server Setup** link in the **Authentication and Accounting** screen to view the screen as shown.

Figure 100 Advanced Application > Auth and Acct > TACACS+ Server Setup



The following table describes the labels in this screen.

Table 64 Advanced Application > Auth and Acct > TACACS+ Server Setup

LABEL	DESCRIPTION
Authentication Server	Use this section to configure your TACACS+ authentication settings.
Mode	This field is only valid if you configure multiple TACACS+ servers. Select **index-priority** and the Switch tries to authenticate with the first configured TACACS+ server, if the TACACS+ server does not respond then the Switch tries to authenticate with the second TACACS+ server. Select **round-robin** to alternate between the TACACS+ servers that it sends authentication requests to.
Timeout	Specify the amount of time in seconds that the Switch waits for an authentication request response from the TACACS+ server. If you are using **index-priority** for your authentication and you are using two TACACS+ servers then the timeout value is divided between the two TACACS+ servers. For example, if you set the timeout value to 30 seconds, then the Switch waits for a response from the first TACACS+ server for 15 seconds and then tries the second TACACS+ server.
Index	This is a read-only number representing a TACACS+ server entry.
IP Address	Enter the IP address of an external TACACS+ server in dotted decimal notation.
TCP Port	The default port of a TACACS+ server for authentication is **49**. You need not change this value unless your network administrator instructs you to do so.

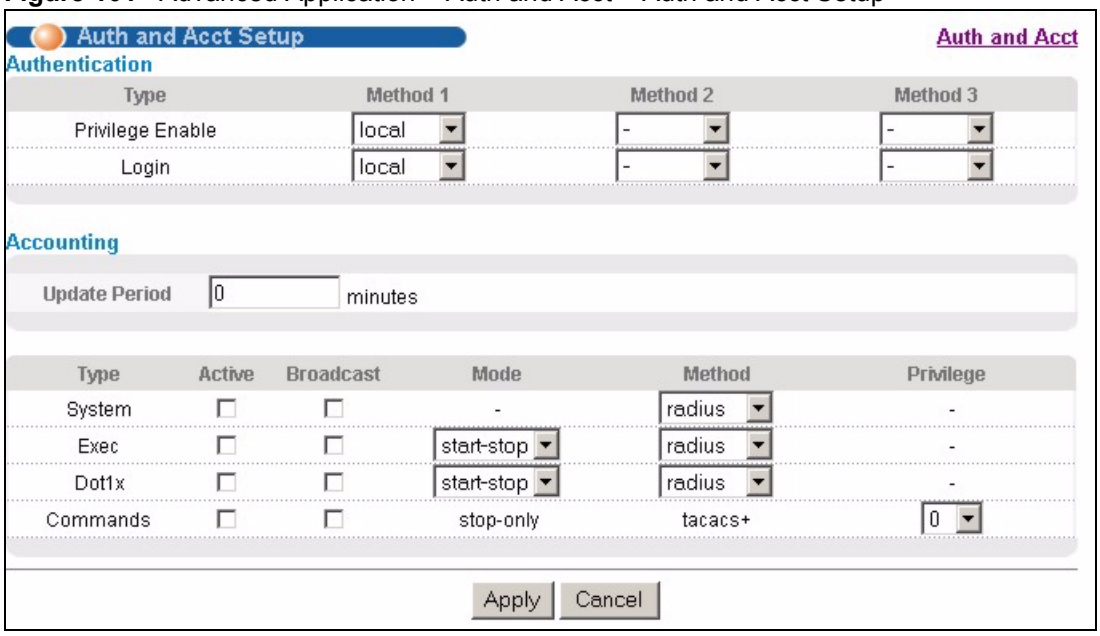
Table 64 Advanced Application > Auth and Acct > TACACS+ Server Setup (continued)

LABEL	DESCRIPTION
Shared Secret	Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external TACACS+ server and the Switch. This key is not sent over the network. This key must be the same on the external TACACS+ server and the Switch.
Delete	Check this box if you want to remove an existing TACACS+ server entry from the Switch. This entry is deleted when you click **Apply**.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Accounting Server	Use this section to configure your TACACS+ accounting settings.
Timeout	Specify the amount of time in seconds that the Switch waits for an accounting request response from the TACACS+ server.
Index	This is a read-only number representing a TACACS+ accounting server entry.
IP Address	Enter the IP address of an external TACACS+ accounting server in dotted decimal notation.
TCP Port	The default port of a TACACS+ accounting server is **49**. You need not change this value unless your network administrator instructs you to do so.
Shared Secret	Specify a password (up to 32 alphanumeric characters) as the key to be shared between the external TACACS+ accounting server and the Switch. This key is not sent over the network. This key must be the same on the external TACACS+ accounting server and the Switch.
Delete	Check this box if you want to remove an existing TACACS+ accounting server entry from the Switch. This entry is deleted when you click **Apply**.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

23.2.3 Authentication and Accounting Setup

Use this screen to configure authentication and accounting settings on the Switch. Click on the **Auth and Acct Setup** link in the **Authentication and Accounting** screen to view the screen as shown.

Figure 101 Advanced Application > Auth and Acct > Auth and Acct Setup



The following table describes the labels in this screen.

Table 65 Advanced Application > Auth and Acct > Auth and Acct Setup

LABEL	DESCRIPTION
Authentication	Use this section to specify the methods used to authenticate users accessing the Switch.
Privilege Enable	These fields specify which database the Switch should use (first, second and third) to authenticate access privilege level for administrator accounts (users for Switch management). Configure the access privilege of accounts via commands (See the CLI Reference Guide) for **local** authentication. The **TACACS+** and **RADIUS** are external servers. Before you specify the priority, make sure you have set up the corresponding database correctly first. You can specify up to three methods for the Switch to authenticate the access privilege level of administrators. The Switch checks the methods in the order you configure them (first **Method 1**, then **Method 2** and finally **Method 3**). You must configure the settings in the **Method 1** field. If you want the Switch to check other sources for access privilege level specify them in **Method 2** and **Method 3** fields. Select **local** to have the Switch check the access privilege configured for local authentication. Select **radius** or **tacacs+** to have the Switch check the access privilege via the external servers.

Table 65 Advanced Application > Auth and Acct > Auth and Acct Setup (continued)

LABEL	DESCRIPTION
Login	These fields specify which database the Switch should use (first, second and third) to authenticate administrator accounts (users for Switch management). Configure the local user accounts in the **Access Control > Logins** screen. The TACACS+ and RADIUS are external servers. Before you specify the priority, make sure you have set up the corresponding database correctly first. You can specify up to three methods for the Switch to authenticate administrator accounts. The Switch checks the methods in the order you configure them (first **Method 1**, then **Method 2** and finally **Method 3**). You must configure the settings in the **Method 1** field. If you want the Switch to check other sources for administrator accounts, specify them in **Method 2** and **Method 3** fields. Select **local** to have the Switch check the administrator accounts configured in the **Access Control > Logins** screen. Select **radius** to have the Switch authenticate administrator accounts through a RADIUS server. Select **tacacs+** to have the Switch authenticate administrator accounts through a TACACS+ server.
Accounting	Use this section to configure accounting settings on the Switch.
Update Period	This is the amount of time in minutes before the Switch sends an update to the accounting server. This is only valid if you select the **start-stop** option for the **Exec** or **Dot1x** entries.
Type	The Switch supports the following types of events to be sent to the accounting server(s): • **System** - Configure the Switch to send information when the following system events occur: system boots up, system shuts down, system accounting is enabled, system accounting is disabled. • **Exec** - Configure the Switch to send information when an administrator logs in and logs out via the console port, telnet or SSH. • **Dot1x** - Configure the Switch to send information when an IEEE 802.1x client begins a session (authenticates via the Switch), ends a session as well as interim updates of a session. • **Commands** - Configure the Switch to send information when commands of specified privilege level and higher are executed on the Switch.
Active	Select this to activate accounting for a specified event types.
Broadcast	Select this to have the Switch send accounting information to all configured accounting servers at the same time. If you don't select this and you have two accounting servers set up, then the Switch sends information to the first accounting server and if it doesn't get a response from the accounting server then it tries the second accounting server.
Mode	The Switch supports two modes of recording login events. Select: • **start-stop** - to have the Switch send information to the accounting server when a user begins a session, during a user's session (if it lasts past the **Update Period**), and when a user ends a session. • **stop-only** - to have the Switch send information to the accounting server only when a user ends a session.
Method	Select whether you want to use RADIUS or TACACS+ for accounting of specific types of events. TACACS+ is the only method for recording **Commands** type of event.
Privilege	This field is only configurable for **Commands** type of event. Select the threshold command privilege level for which the Switch should send accounting information. The Switch will send accounting information when commands at the level you specify and higher are executed on the Switch.

Table 65 Advanced Application > Auth and Acct > Auth and Acct Setup (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

23.2.4 Vendor Specific Attribute

RFC 2865 standard specifies a method for sending vendor-specific information between a RADIUS server and a network access device (for example, the Switch). A company can create Vendor Specific Attributes (VSAs) to expand the functionality of a RADIUS server.

The Switch supports VSAs that allow you to perform the following actions based on user authentication:

- Limit bandwidth on incoming or outgoing traffic for the port the user connects to.
- Assign account privilege levels (See the CLI Reference Guide for more information on account privilege levels) for the authenticated user.

The VSAs are composed of the following:

- **Vendor-ID**: An identification number assigned to the company by the IANA (Internet Assigned Numbers Authority). ZyXEL's vendor ID is 890.
- **Vendor-Type**: A vendor specified attribute, identifying the setting you want to modify.
- **Vendor-data**: A value you want to assign to the setting.



Refer to the documentation that comes with your RADIUS server on how to configure VSAs for users authenticating via the RADIUS server.

The following table describes the VSAs supported on the Switch.

Table 66 Supported VSAs

FUNCTION	ATTRIBUTE

Ingress Bandwidth Assignment	`Vendor-Id = 890`
	`Vendor-Type = 1`
	`Vendor-data =` ingress rate (Kbps in decimal format)

Table 66 Supported VSAs

FUNCTION	ATTRIBUTE
Egress Bandwidth Assignment	Vendor-Id = **890** Vendor-Type = **2** Vendor-data = egress rate (Kbps in decimal format)
Privilege Assignment	Vendor-ID = **890** Vendor-Type = **3** Vendor-Data = **"shell:priv-lvl=**N" or Vendor-ID = **9** (CISCO) Vendor-Type = **1** (CISCO-AVPAIR) Vendor-Data = **"shell:priv-lvl=**N" where N is a privilege level (from 0 to 14). Note: If you set the privilege level of a login account differently on the RADIUS server(s) and the Switch, the user is assigned a privilege level from the database (RADIUS or local) the Switch uses first for user authentication.

23.2.4.1 Tunnel Protocol Attribute

You can configure tunnel protocol attributes on the RADIUS server (refer to your RADIUS server documentation) to assign a port on the Switch to a VLAN based on IEEE 802.1x authentication. The port VLAN settings are fixed and untagged. This will also set the port's VID. The following table describes the values you need to configure. Note that the bolded values in the table are fixed values as defined in RFC 3580.

Table 67 Supported Tunnel Protocol Attribute

FUNCTION	ATTRIBUTE
VLAN Assignment	Tunnel-Type = **VLAN(13)** Tunnel-Medium-Type = **802(6)** Tunnel-Private-Group-ID = VLAN ID Note: You must also create a VLAN with the specified VID on the Switch.

23.3 Supported RADIUS Attributes

Remote Authentication Dial-In User Service (RADIUS) attributes are data used to define specific authentication, and accounting elements in a user profile, which is stored on the RADIUS server. This appendix lists the RADIUS attributes supported by the Switch.

Refer to RFC 2865 for more information about RADIUS attributes used for authentication. Refer to RFC 2866 and RFC 2869 for RADIUS attributes used for accounting.

This appendix lists the attributes used by authentication and accounting functions on the Switch. In cases where the attribute has a specific format associated with it, the format is specified.

23.3.1 Attributes Used for Authentication

The following sections list the attributes sent from the Switch to the RADIUS server when performing authentication.

23.3.1.1 Attributes Used for Authenticating Privilege Access

User-Name

- the format of the User-Name attribute is **$enab#$**, where # is the privilege level (1-14)

User-Password

NAS-Identifier

NAS-IP-Address

23.3.1.2 Attributes Used to Login Users

User-Name

User-Password

NAS-Identifier

NAS-IP-Address

23.3.1.3 Attributes Used by the IEEE 802.1x Authentication

User-Name

NAS-Identifier

NAS-IP-Address

NAS-Port

NAS-Port-Type

- This value is set to **Ethernet(15)** on the Switch.

Calling-Station-Id

Frame-MTU

EAP-Message

State

Message-Authenticator

23.3.2 Attributes Used for Accounting

The following sections list the attributes sent from the Switch to the RADIUS server when performing authentication.

23.3.2.1 Attributes Used for Accounting System Events

NAS-IP-Address

NAS-Identifier

Acct-Status-Type

Acct-Session-ID

- The format of Acct-Session-Id is **date+time+8-digit sequential number**, for example, 200704191721030000000001. (date: 2007/04/19, time: 17:21:03, serial number: 00000001)

Acct-Delay-Time

23.3.2.2 Attributes Used for Accounting Exec Events

The attributes are listed in the following table along with the time that they are sent (the difference between Console and Telnet/SSH Exec events is that the Telnet/SSH events utilize the Calling-Station-Id attribute):

Table 68 RADIUS Attributes - Exec Events via Console

ATTRIBUTE	START	INTERIM-UPDATE	STOP
User-Name	Y	Y	Y
NAS-Identifier	Y	Y	Y
NAS-IP-Address	Y	Y	Y
Service-Type	Y	Y	Y
Acct-Status-Type	Y	Y	Y
Acct-Delay-Time	Y	Y	Y
Acct-Session-Id	Y	Y	Y
Acct-Authentic	Y	Y	Y
Acct-Session-Time		Y	Y
Acct-Terminate-Cause			Y

Table 69 RADIUS Attributes - Exec Events via Telnet/SSH

ATTRIBUTE	START	INTERIM-UPDATE	STOP
User-Name	Y	Y	Y
NAS-Identifier	Y	Y	Y
NAS-IP-Address	Y	Y	Y
Service-Type	Y	Y	Y
Calling-Station-Id	Y	Y	Y
Acct-Status-Type	Y	Y	Y
Acct-Delay-Time	Y	Y	Y
Acct-Session-Id	Y	Y	Y
Acct-Authentic	Y	Y	Y
Acct-Session-Time		Y	Y
Acct-Terminate-Cause			Y

23.3.2.3 Attributes Used for Accounting IEEE 802.1x Events

The attributes are listed in the following table along with the time of the session they are sent:

Table 70 RADIUS Attributes - Exec Events via Console

ATTRIBUTE	START	INTERIM-UPDATE	STOP
User-Name	Y	Y	Y
NAS-IP-Address	Y	Y	Y
NAS-Port	Y	Y	Y
Class	Y	Y	Y
Called-Station-Id	Y	Y	Y
Calling-Station-Id	Y	Y	Y
NAS-Identifier	Y	Y	Y

Table 70 RADIUS Attributes - Exec Events via Console

ATTRIBUTE	START	INTERIM-UPDATE	STOP
NAS-Port-Type	Y	Y	Y
Acct-Status-Type	Y	Y	Y
Acct-Delay-Time	Y	Y	Y
Acct-Session-Id	Y	Y	Y
Acct-Authentic	Y	Y	Y
Acct-Input-Octets		Y	Y
Acct-Output-Octets		Y	Y
Acct-Session-Time		Y	Y
Acct-Input-Packets		Y	Y
Acct-Output-Packets		Y	Y
Acct-Terminate-Cause			Y
Acct-Input-Gigawords		Y	Y
Acct-Output-Gigawords		Y	Y

24

IP Source Guard

Use IP source guard to filter unauthorized DHCP and ARP packets in your network.

24.1 IP Source Guard Overview

IP source guard uses a binding table to distinguish between authorized and unauthorized DHCP and ARP packets in your network. A binding contains these key attributes:

- MAC address
- VLAN ID
- IP address
- Port number

When the Switch receives a DHCP or ARP packet, it looks up the appropriate MAC address, VLAN ID, IP address, and port number in the binding table. If there is a binding, the Switch forwards the packet. If there is not a binding, the Switch discards the packet.

The Switch builds the binding table by snooping DHCP packets (dynamic bindings) and from information provided manually by administrators (static bindings).

IP source guard consists of the following features:

- Static bindings. Use this to create static bindings in the binding table.
- DHCP snooping. Use this to filter unauthorized DHCP packets on the network and to build the binding table dynamically.
- ARP inspection. Use this to filter unauthorized ARP packets on the network.

If you want to use dynamic bindings to filter unauthorized ARP packets (typical implementation), you have to enable DHCP snooping before you enable ARP inspection.

24.1.1 DHCP Snooping Overview

Use DHCP snooping to filter unauthorized DHCP packets on the network and to build the binding table dynamically. This can prevent clients from getting IP addresses from unauthorized DHCP servers.

24.1.1.1 Trusted vs. Untrusted Ports

Every port is either a trusted port or an untrusted port for DHCP snooping. This setting is independent of the trusted/untrusted setting for ARP inspection. You can also specify the maximum number for DHCP packets that each port (trusted or untrusted) can receive each second.

Trusted ports are connected to DHCP servers or other switches. The Switch discards DHCP packets from trusted ports only if the rate at which DHCP packets arrive is too high. The Switch learns dynamic bindings from trusted ports.



The Switch will drop all DHCP requests if you enable DHCP snooping and there are no trusted ports.

Untrusted ports are connected to subscribers. The Switch discards DHCP packets from untrusted ports in the following situations:

- The packet is a DHCP server packet (for example, OFFER, ACK, or NACK).
- The source MAC address and source IP address in the packet do not match any of the current bindings.
- The packet is a RELEASE or DECLINE packet, and the source MAC address and source port do not match any of the current bindings.
- The rate at which DHCP packets arrive is too high.

24.1.1.2 DHCP Snooping Database

The Switch stores the binding table in volatile memory. If the Switch restarts, it loads static bindings from permanent memory but loses the dynamic bindings, in which case the devices in the network have to send DHCP requests again. As a result, it is recommended you configure the DHCP snooping database.

The DHCP snooping database maintains the dynamic bindings for DHCP snooping and ARP inspection in a file on an external TFTP server. If you set up the DHCP snooping database, the Switch can reload the dynamic bindings from the DHCP snooping database after the Switch restarts.

You can configure the name and location of the file on the external TFTP server. The file has the following format:

Figure 102 DHCP Snooping Database File Format

```
<initial-checksum>
TYPE DHCP-SNOOPING
VERSION 1
BEGIN
<binding-1> <checksum-1>
<binding-2> <checksum-1-2>
...
...
<binding-n> <checksum-1-2-..-n>
END
```

The <initial-checksum> helps distinguish between the bindings in the latest update and the bindings from previous updates. Each binding consists of 72 bytes, a space, and another checksum that is used to validate the binding when it is read. If the calculated checksum is not equal to the checksum in the file, that binding and all others after it are ignored.

24.1.1.3 DHCP Relay Option 82 Information

The Switch can add information to DHCP requests that it does not discard. This provides the DHCP server more information about the source of the requests. The Switch can add the following information:

- Slot ID (1 byte), port ID (1 byte), and source VLAN ID (2 bytes)
- System name (up to 32 bytes)

This information is stored in an Agent Information field in the option 82 field of the DHCP headers of client DHCP request frames. See Chapter 28 on page 235 for more information about DHCP relay option 82.

When the DHCP server responds, the Switch removes the information in the Agent Information field before forwarding the response to the original source.

You can configure this setting for each source VLAN. This setting is independent of the DHCP relay settings (Chapter 28 on page 235).

24.1.1.4 Configuring DHCP Snooping

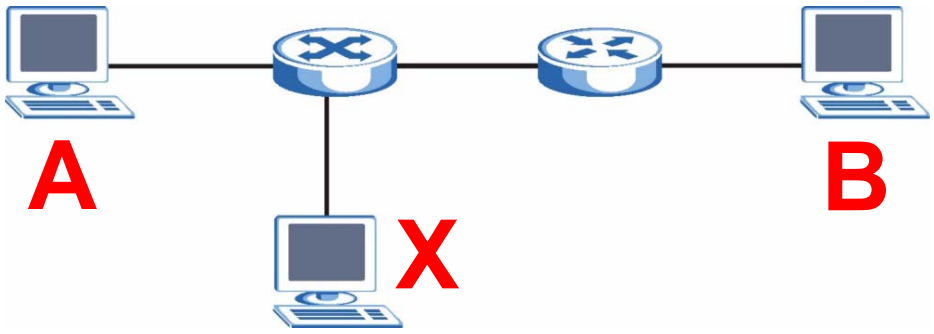
Follow these steps to configure DHCP snooping on the Switch.

1. Enable DHCP snooping on the Switch.
2. Enable DHCP snooping on each VLAN, and configure DHCP relay option 82.
3. Configure trusted and untrusted ports, and specify the maximum number of DHCP packets that each port can receive per second.
4. Configure static bindings.

24.1.2 ARP Inspection Overview

Use ARP inspection to filter unauthorized ARP packets on the network. This can prevent many kinds of man-in-the-middle attacks, such as the one in the following example.

Figure 103 Example: Man-in-the-middle Attack



In this example, computer **B** tries to establish a connection with computer **A**. Computer **X** is in the same broadcast domain as computer **A** and intercepts the ARP request for computer **A**. Then, computer **X** does the following things:

- It pretends to be computer **A** and responds to computer **B**.
- It pretends to be computer **B** and sends a message to computer **A**.

As a result, all the communication between computer **A** and computer **B** passes through computer **X**. Computer **X** can read and alter the information passed between them.

24.1.2.1 ARP Inspection and MAC Address Filters

When the Switch identifies an unauthorized ARP packet, it automatically creates a MAC address filter to block traffic from the source MAC address and source VLAN ID of the unauthorized ARP packet. You can configure how long the MAC address filter remains in the Switch.

These MAC address filters are different than regular MAC address filters (Chapter 10 on page 107).

- They are stored only in volatile memory.
- They do not use the same space in memory that regular MAC address filters use.
- They appear only in the **ARP Inspection** screens and commands, not in the **MAC Address Filter** screens and commands.

24.1.2.2 Trusted vs. Untrusted Ports

Every port is either a trusted port or an untrusted port for ARP inspection. This setting is independent of the trusted/untrusted setting for DHCP snooping.

The Switch does not discard ARP packets on trusted ports for any reason.

The Switch discards ARP packets on untrusted ports if the sender's information in the ARP packet does not match any of the current bindings.

24.1.2.3 Syslog

The Switch can send syslog messages to the specified syslog server (Chapter 32 on page 269) when it forwards or discards ARP packets. The Switch can consolidate log messages and send log messages in batches to make this mechanism more efficient.

24.1.2.4 Configuring ARP Inspection

Follow these steps to configure ARP inspection on the Switch.

1. Configure DHCP snooping. See Section 24.1.1.4 on page 203.



It is recommended you enable DHCP snooping at least one day before you enable ARP inspection so that the Switch has enough time to build the binding table.

2. Enable ARP inspection on each VLAN.
3. Configure trusted and untrusted ports, and specify the maximum number of ARP packets that each port can receive per second.

24.2 IP Source Guard

Use this screen to look at the current bindings for DHCP snooping and ARP inspection. Bindings are used by DHCP snooping and ARP inspection to distinguish between authorized and unauthorized packets in the network. The Switch learns the bindings by snooping DHCP packets (dynamic bindings) and from information provided manually by administrators (static bindings). To open this screen, click **Advanced Application > IP Source Guard**.

Figure 104 Advanced Application > IP Source Guard



The following table describes the labels in this screen.

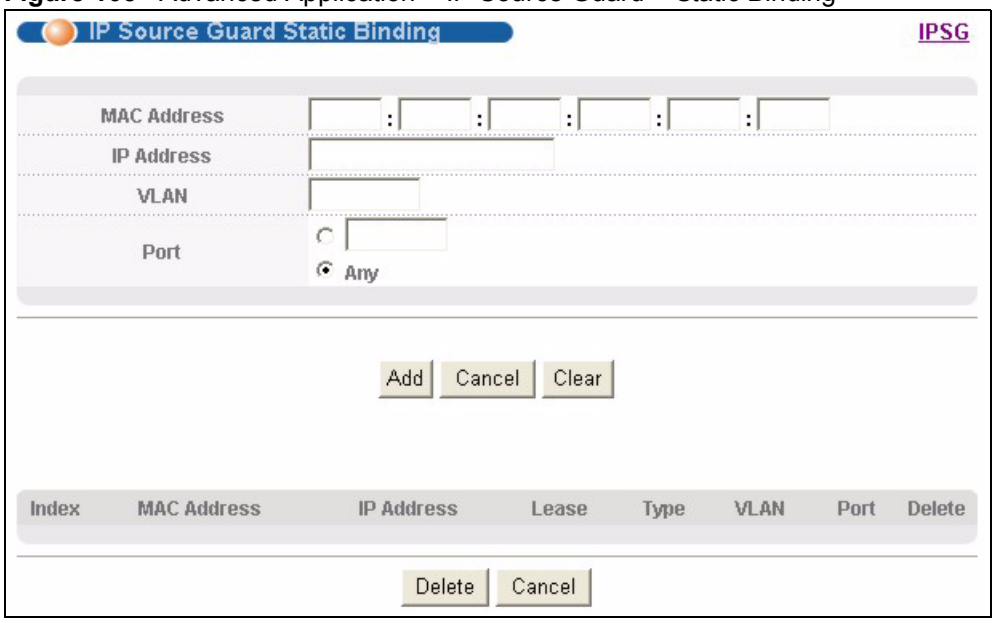
Table 71 Advanced Application > IP Source Guard

LABEL	DESCRIPTION
Index	This field displays a sequential number for each binding.
MAC Address	This field displays the source MAC address in the binding.
IP Address	This field displays the IP address assigned to the MAC address in the binding.
Lease	This field displays how many days, hours, minutes, and seconds the binding is valid; for example, **2d3h4m5s** means the binding is still valid for 2 days, 3 hours, 4 minutes, and 5 seconds. This field displays **infinity** if the binding is always valid (for example, a static binding).
Type	This field displays how the Switch learned the binding. **static**: This binding was learned from information provided manually by an administrator. **dhcp-snooping**: This binding was learned by snooping DHCP packets.
VID	This field displays the source VLAN ID in the binding.
Port	This field displays the port number in the binding. If this field is blank, the binding applies to all ports.

24.3 IP Source Guard Static Binding

Use this screen to manage static bindings for DHCP snooping and ARP inspection. Static bindings are uniquely identified by the MAC address and VLAN ID. Each MAC address and VLAN ID can only be in one static binding. If you try to create a static binding with the same MAC address and VLAN ID as an existing static binding, the new static binding replaces the original one. To open this screen, click **Advanced Application > IP Source Guard > Static Binding**.

Figure 105 Advanced Application > IP Source Guard > Static Binding



The following table describes the labels in this screen.

Table 72 Advanced Application > IP Source Guard > Static Binding

LABEL	DESCRIPTION
MAC Address	Enter the source MAC address in the binding.
IP Address	Enter the IP address assigned to the MAC address in the binding.
VLAN	Enter the source VLAN ID in the binding.
Port	Specify the port(s) in the binding. If this binding has one port, select the first radio button and enter the port number in the field to the right. If this binding applies to all ports, select **Any**.
Add	Click this to create the specified static binding or to update an existing one.
Cancel	Click this to reset the values above based on the last selected static binding or, if not applicable, to clear the fields above.
Clear	Click this to clear the fields above.
Index	This field displays a sequential number for each binding.
MAC Address	This field displays the source MAC address in the binding.
IP Address	This field displays the IP address assigned to the MAC address in the binding.
Lease	This field displays how long the binding is valid.
Type	This field displays how the Switch learned the binding. **static**: This binding was learned from information provided manually by an administrator.
VLAN	This field displays the source VLAN ID in the binding.
Port	This field displays the port number in the binding. If this field is blank, the binding applies to all ports.
Delete	Select this, and click **Delete** to remove the specified entry.
Cancel	Click this to clear the **Delete** check boxes above.

24.4 DHCP Snooping

Use this screen to look at various statistics about the DHCP snooping database. To open this screen, click **Advanced Application > IP Source Guard > DHCP Snooping**.

Figure 106 Advanced Application > IP Source Guard > DHCP Snooping

DHCP Snooping Configure IPSG

Database Status

Description	Status	
Agent URL		
Write delay timer	300	seconds
Abort timer	300	seconds
Agent running	None	
Delay timer expiry	Not Running	
Abort timer expiry	Not Running	
Last succeeded time	None	
Last failed time	None	
Last failed reason	No failure recorded	
	Times	
Total attempts	0	
Startup failures	0	
Successful transfers	0	
Failed transfers	0	
Successful reads	0	
Failed reads	0	
Successful writes	0	
Failed writes	0	

Database detail

Description	Status
First successful access	None
Last ignored bindings counters	
Binding collisions	0
Invalid interfaces	0
Parse failures	0
Expired leases	0
Unsupported vlans	0
Last ignored time	None
Total ignored bindings counters	
Binding collisions	0
Invalid interfaces	0
Parse failures	0
Expired leases	0
Unsupported vlans	0

The following table describes the labels in this screen.

Table 73 Advanced Application > IP Source Guard > DHCP Snooping

LABEL	DESCRIPTION
Database Status	
	This section displays the current settings for the DHCP snooping database. You can configure them in the **DHCP Snooping Configure** screen. See Section 24.5 on page 210.
Agent URL	This field displays the location of the DHCP snooping database.
Write delay timer	This field displays how long (in seconds) the Switch tries to complete a specific update in the DHCP snooping database before it gives up.
Abort timer	This field displays how long (in seconds) the Switch waits to update the DHCP snooping database after the current bindings change.
	This section displays information about the current update and the next update of the DHCP snooping database.
Agent running	This field displays the status of the current update or access of the DHCP snooping database. **none**: The Switch is not accessing the DHCP snooping database. **read**: The Switch is loading dynamic bindings from the DHCP snooping database. **write**: The Switch is updating the DHCP snooping database.
Delay timer expiry	This field displays how much longer (in seconds) the Switch tries to complete the current update before it gives up. It displays **Not Running** if the Switch is not updating the DHCP snooping database right now.
Abort timer expiry	This field displays when (in seconds) the Switch is going to update the DHCP snooping database again. It displays **Not Running** if the current bindings have not changed since the last update.
	This section displays information about the last time the Switch updated the DHCP snooping database.
Last succeeded time	This field displays the last time the Switch updated the DHCP snooping database successfully.
Last failed time	This field displays the last time the Switch updated the DHCP snooping database unsuccessfully.
Last failed reason	This field displays the reason the Switch updated the DHCP snooping database unsuccessfully.
	This section displays historical information about the number of times the Switch successfully or unsuccessfully read or updated the DHCP snooping database.
Total attempts	This field displays the number of times the Switch has tried to access the DHCP snooping database for any reason.
Startup failures	This field displays the number of times the Switch could not create or read the DHCP snooping database when the Switch started up or a new URL is configured for the DHCP snooping database.
Successful transfers	This field displays the number of times the Switch read bindings from or updated the bindings in the DHCP snooping database successfully.
Failed transfers	This field displays the number of times the Switch was unable to read bindings from or update the bindings in the DHCP snooping database.
Successful reads	This field displays the number of times the Switch read bindings from the DHCP snooping database successfully.
Failed reads	This field displays the number of times the Switch was unable to read bindings from the DHCP snooping database.

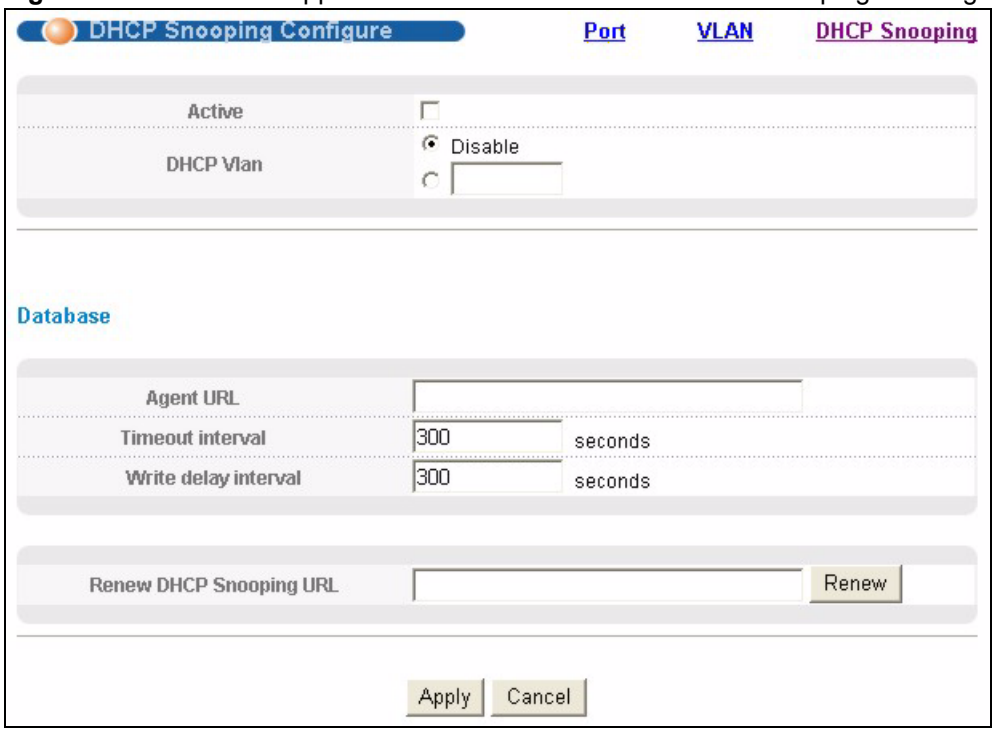
Table 73 Advanced Application > IP Source Guard > DHCP Snooping (continued)

LABEL	DESCRIPTION
Successful writes	This field displays the number of times the Switch updated the bindings in the DHCP snooping database successfully.
Failed writes	This field displays the number of times the Switch was unable to update the bindings in the DHCP snooping database.
Database detail	
First successful access	This field displays the first time the Switch accessed the DHCP snooping database for any reason.
Last ignored bindings counters	This section displays the number of times and the reasons the Switch ignored bindings the last time it read bindings from the DHCP binding database. You can clear these counters by restarting the Switch or using CLI commands. See the CLI Reference Guide.
Binding collisions	This field displays the number of bindings the Switch ignored because the Switch already had a binding with the same MAC address and VLAN ID.
Invalid interfaces	This field displays the number of bindings the Switch ignored because the port number was a trusted interface or does not exist anymore.
Parse failures	This field displays the number of bindings the Switch ignored because the Switch was unable to understand the binding in the DHCP binding database.
Expired leases	This field displays the number of bindings the Switch ignored because the lease time had already expired.
Unsupported vlans	This field displays the number of bindings the Switch ignored because the VLAN ID does not exist anymore.
Last ignored time	This field displays the last time the Switch ignored any bindings for any reason from the DHCP binding database.
Total ignored bindings counters	This section displays the reasons the Switch has ignored bindings any time it read bindings from the DHCP binding database. You can clear these counters by restarting the Switch or using CLI commands. See the CLI Reference Guide.
Binding collisions	This field displays the number of bindings the Switch has ignored because the Switch already had a binding with the same MAC address and VLAN ID.
Invalid interfaces	This field displays the number of bindings the Switch has ignored because the port number was a trusted interface or does not exist anymore.
Parse failures	This field displays the number of bindings the Switch has ignored because the Switch was unable to understand the binding in the DHCP binding database.
Expired leases	This field displays the number of bindings the Switch has ignored because the lease time had already expired.
Unsupported vlans	This field displays the number of bindings the Switch has ignored because the VLAN ID does not exist anymore.

24.5 DHCP Snooping Configure

Use this screen to enable DHCP snooping on the Switch (not on specific VLAN), specify the VLAN where the default DHCP server is located, and configure the DHCP snooping database. The DHCP snooping database stores the current bindings on a secure, external TFTP server so that they are still available after a restart. To open this screen, click **Advanced Application > IP Source Guard > DHCP Snooping > Configure**.

Figure 107 Advanced Application > IP Source Guard > DHCP Snooping > Configure



The following table describes the labels in this screen.

Table 74 Advanced Application > IP Source Guard > DHCP Snooping > Configure

LABEL	DESCRIPTION
Active	Select this to enable DHCP snooping on the Switch. You still have to enable DHCP snooping on specific VLAN and specify trusted ports. Note: The Switch will drop all DHCP requests if you enable DHCP snooping and there are no trusted ports.
DHCP Vlan	Select a VLAN ID if you want the Switch to forward DHCP packets to DHCP servers on a specific VLAN. Note: You have to enable DHCP snooping on the DHCP VLAN too. You can enable **Option82** in the **DHCP Snooping VLAN Configure** screen (Section 24.5.2 on page 213) to help the DHCP servers distinguish between DHCP requests from different VLAN. Select **Disable** if you do not want the Switch to forward DHCP packets to a specific VLAN.

Table 74 Advanced Application > IP Source Guard > DHCP Snooping > Configure

LABEL	DESCRIPTION
Database	If **Timeout interval** is greater than **Write delay interval**, it is possible that the next update is scheduled to occur before the current update has finished successfully or timed out. In this case, the Switch waits to start the next update until it completes the current one.
Agent URL	Enter the location of the DHCP snooping database. The location should be expressed like this: **tftp://{domain name or IP address}/directory, if applicable/file name**; for example, **tftp://192.168.10.1/database.txt**.
Timeout interval	Enter how long (10-65535 seconds) the Switch tries to complete a specific update in the DHCP snooping database before it gives up.
Write delay interval	Enter how long (10-65535 seconds) the Switch waits to update the DHCP snooping database the first time the current bindings change after an update. Once the next update is scheduled, additional changes in current bindings are automatically included in the next update.
Renew DHCP Snooping URL	Enter the location of a DHCP snooping database, and click **Renew** if you want the Switch to load it. You can use this to load dynamic bindings from a different DHCP snooping database than the one specified in **Agent URL**. When the Switch loads dynamic bindings from a DHCP snooping database, it does not discard the current dynamic bindings first. If there is a conflict, the Switch keeps the dynamic binding in volatile memory and updates the **Binding collisions** counter in the **DHCP Snooping** screen (Section 24.4 on page 207).
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click this to reset the values in this screen to their last-saved values.

24.5.1 DHCP Snooping Port Configure

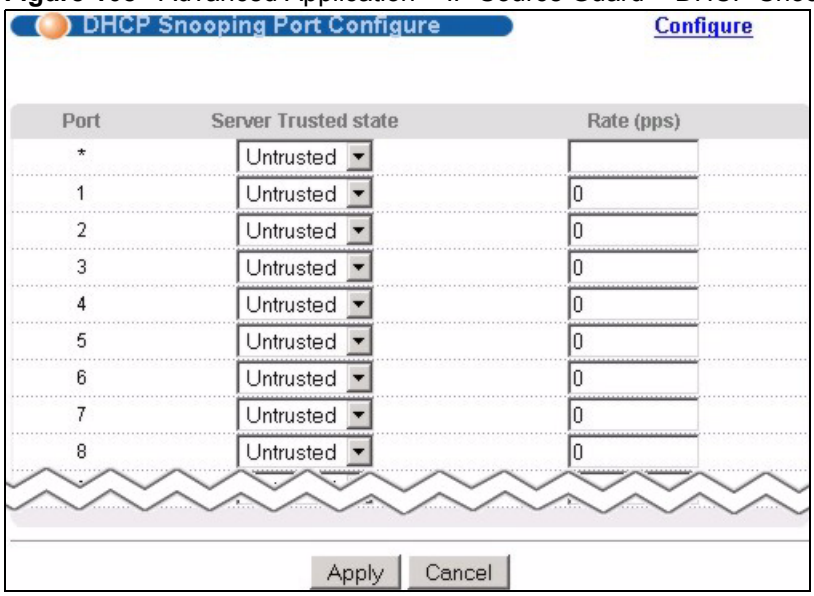
Use this screen to specify whether ports are trusted or untrusted ports for DHCP snooping.



The Switch will drop all DHCP requests if you enable DHCP snooping and there are no trusted ports.

You can also specify the maximum number for DHCP packets that each port (trusted or untrusted) can receive each second. To open this screen, click **Advanced Application > IP Source Guard > DHCP Snooping > Configure > Port**.

Figure 108 Advanced Application > IP Source Guard > DHCP Snooping > Configure > Port



The following table describes the labels in this screen.

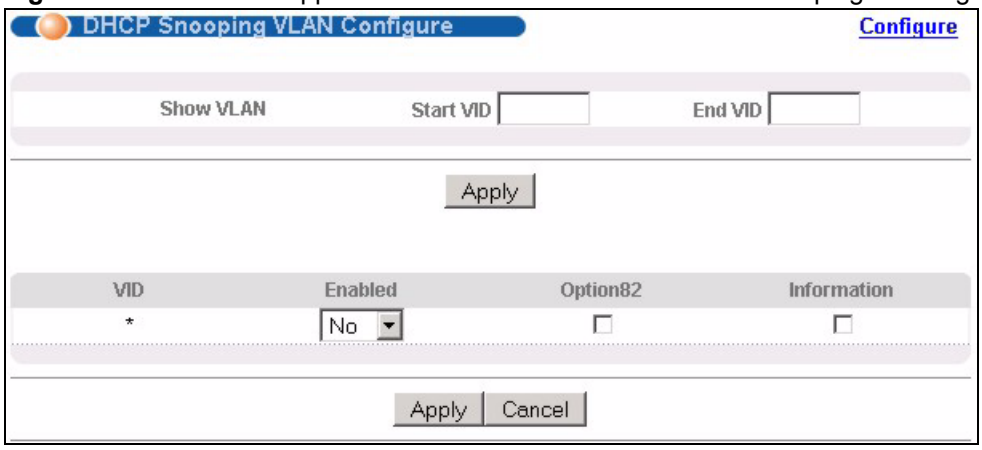
Table 75 Advanced Application > IP Source Guard > DHCP Snooping > Configure > Port

LABEL	DESCRIPTION
Port	This field displays the port number. If you configure the * port, the settings are applied to all of the ports.
Server Trusted state	Select whether this port is a trusted port (**Trusted**) or an untrusted port (**Untrusted**). Trusted ports are connected to DHCP servers or other switches, and the Switch discards DHCP packets from trusted ports only if the rate at which DHCP packets arrive is too high. Untrusted ports are connected to subscribers, and the Switch discards DHCP packets from untrusted ports in the following situations: • The packet is a DHCP server packet (for example, OFFER, ACK, or NACK). • The source MAC address and source IP address in the packet do not match any of the current bindings. • The packet is a RELEASE or DECLINE packet, and the source MAC address and source port do not match any of the current bindings. • The rate at which DHCP packets arrive is too high.
Rate (pps)	Specify the maximum number for DHCP packets (1-2048) that the Switch receives from each port each second. The Switch discards any additional DHCP packets. Enter 0 to disable this limit, which is recommended for trusted ports.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click this to reset the values in this screen to their last-saved values.

24.5.2 DHCP Snooping VLAN Configure

Use this screen to enable DHCP snooping on each VLAN and to specify whether or not the Switch adds DHCP relay agent option 82 information (Chapter 28 on page 235) to DHCP requests that the Switch relays to a DHCP server for each VLAN. To open this screen, click **Advanced Application > IP Source Guard > DHCP Snooping > Configure > VLAN**.

Figure 109 Advanced Application > IP Source Guard > DHCP Snooping > Configure > VLAN



The following table describes the labels in this screen.

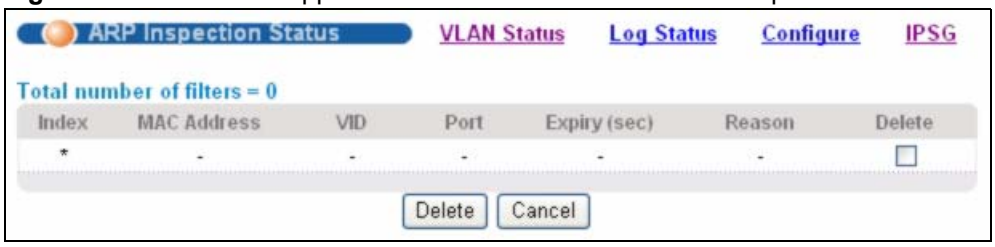
Table 76 Advanced Application > IP Source Guard > DHCP Snooping > Configure > VLAN

LABEL	DESCRIPTION
Show VLAN	Use this section to specify the VLANs you want to manage in the section below.
Start VID	Enter the lowest VLAN ID you want to manage in the section below.
End VID	Enter the highest VLAN ID you want to manage in the section below.
Apply	Click this to display the specified range of VLANs in the section below.
VID	This field displays the VLAN ID of each VLAN in the range specified above. If you configure the * VLAN, the settings are applied to all VLANs.
Enabled	Select **Yes** to enable DHCP snooping on the VLAN. You still have to enable DHCP snooping on the Switch and specify trusted ports. Note: The Switch will drop all DHCP requests if you enable DHCP snooping and there are no trusted ports.
Option82	Select this to have the Switch add the slot number, port number and VLAN ID to DHCP requests that it broadcasts to the DHCP VLAN, if specified, or VLAN. You can specify the DHCP VLAN in the **DHCP Snooping Configure** screen. See Section 24.5 on page 210.
Information	Select this to have the Switch add the system name to DHCP requests that it broadcasts to the DHCP VLAN, if specified, or VLAN. You can configure the system name in the **General Setup** screen. See Chapter 7 on page 75. You can specify the DHCP VLAN in the **DHCP Snooping Configure** screen. See Section 24.5 on page 210.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click this to reset the values in this screen to their last-saved values.

24.6 ARP Inspection Status

Use this screen to look at the current list of MAC address filters that were created because the Switch identified an unauthorized ARP packet. When the Switch identifies an unauthorized ARP packet, it automatically creates a MAC address filter to block traffic from the source MAC address and source VLAN ID of the unauthorized ARP packet. To open this screen, click **Advanced Application > IP Source Guard > ARP Inspection**.

Figure 110 Advanced Application > IP Source Guard > ARP Inspection



The following table describes the labels in this screen.

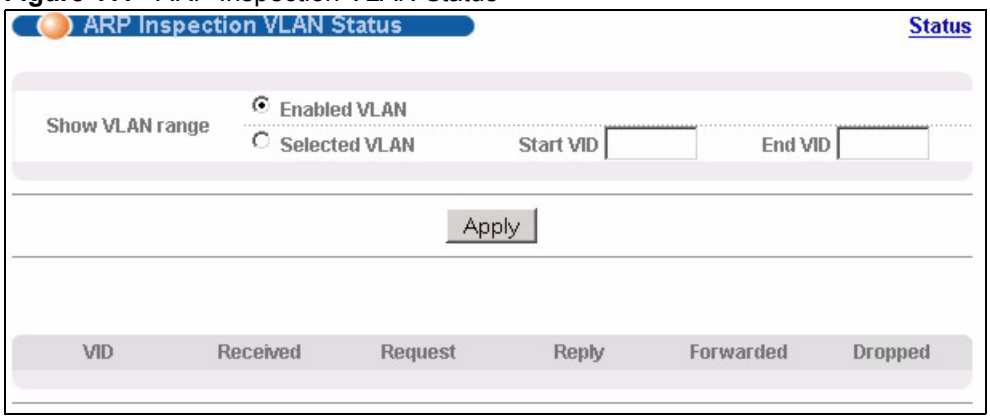
Table 77 Advanced Application > IP Source Guard > ARP Inspection

LABEL	DESCRIPTION
Total number of filters	This field displays the current number of MAC address filters that were created because the Switch identified unauthorized ARP packets.
Index	This field displays a sequential number for each MAC address filter.
MAC Address	This field displays the source MAC address in the MAC address filter.
VID	This field displays the source VLAN ID in the MAC address filter.
Port	This field displays the source port of the discarded ARP packet.
Expiry (sec)	This field displays how long (in seconds) the MAC address filter remains in the Switch. You can also delete the record manually (**Delete**).
Reason	This field displays the reason the ARP packet was discarded. **MAC+VLAN**: The MAC address and VLAN ID were not in the binding table. **IP**: The MAC address and VLAN ID were in the binding table, but the IP address was not valid. **Port**: The MAC address, VLAN ID, and IP address were in the binding table, but the port number was not valid.
Delete	Select this, and click **Delete** to remove the specified entry.
Delete	Click this to remove the selected entries.
Cancel	Click this to clear the **Delete** check boxes above.

24.6.1 ARP Inspection VLAN Status

Use this screen to look at various statistics about ARP packets in each VLAN. To open this screen, click **Advanced Application > IP Source Guard > ARP Inspection > VLAN Status**.

Figure 111 ARP Inspection VLAN Status



The following table describes the labels in this screen.

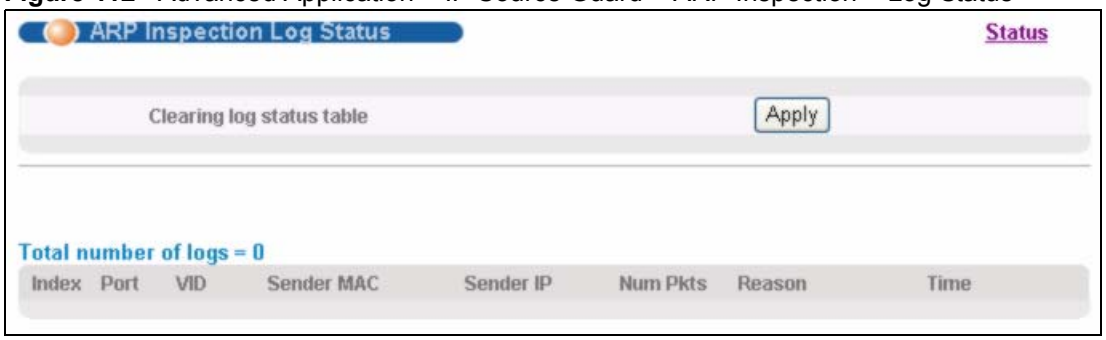
Table 78 ARP Inspection VLAN Status

LABEL	DESCRIPTION
Show VLAN range	Use this section to specify the VLANs you want to look at in the section below.
Enabled VLAN	Select this to look at all the VLANs on which ARP inspection is enabled in the section below.
Selected VLAN	Select this to look at all the VLANs in a specific range in the section below. Then, enter the lowest VLAN ID (**Start VID**) and the highest VLAN ID (**End VID**) you want to look at.
Apply	Click this to display the specified range of VLANs in the section below.
VID	This field displays the VLAN ID of each VLAN in the range specified above.
Received	This field displays the total number of ARP packets received from the VLAN since the Switch last restarted.
Request	This field displays the total number of ARP Request packets received from the VLAN since the Switch last restarted.
Reply	This field displays the total number of ARP Reply packets received from the VLAN since the Switch last restarted.
Forwarded	This field displays the total number of ARP packets the Switch forwarded for the VLAN since the Switch last restarted.
Dropped	This field displays the total number of ARP packets the Switch discarded for the VLAN since the Switch last restarted.

24.6.2 ARP Inspection Log Status

Use this screen to look at log messages that were generated by ARP packets and that have not been sent to the syslog server yet. To open this screen, click **Advanced Application > IP Source Guard > ARP Inspection > Log Status**.

Figure 112 Advanced Application > IP Source Guard > ARP Inspection > Log Status



The following table describes the labels in this screen.

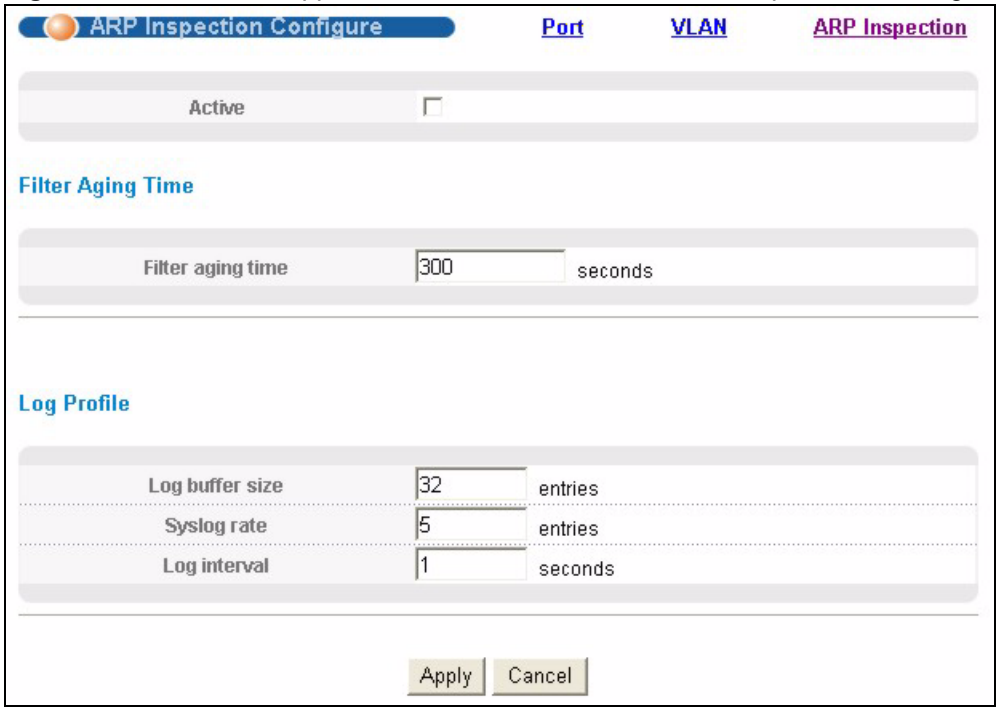
Table 79 Advanced Application > IP Source Guard > ARP Inspection > Log Status

LABEL	DESCRIPTION
Clearing log status table	Click **Apply** to remove all the log messages that were generated by ARP packets and that have not been sent to the syslog server yet.
Total number of logs	This field displays the number of log messages that were generated by ARP packets and that have not been sent to the syslog server yet. If one or more log messages are dropped due to unavailable buffer, there is an entry called **overflow** with the current number of dropped log messages.
Index	This field displays a sequential number for each log message.
Port	This field displays the source port of the ARP packet.
VID	This field displays the source VLAN ID of the ARP packet.
Sender MAC	This field displays the source MAC address of the ARP packet.
Sender IP	This field displays the source IP address of the ARP packet.
Num Pkts	This field displays the number of ARP packets that were consolidated into this log message. The Switch consolidates identical log messages generated by ARP packets in the log consolidation interval into one log message. You can configure this interval in the **ARP Inspection Configure** screen. See Section 24.7 on page 217.
Reason	This field displays the reason the log message was generated. **dhcp deny**: An ARP packet was discarded because it violated a dynamic binding with the same MAC address and VLAN ID. **static deny**: An ARP packet was discarded because it violated a static binding with the same MAC address and VLAN ID. **deny**: An ARP packet was discarded because there were no bindings with the same MAC address and VLAN ID. **dhcp permit**: An ARP packet was forwarded because it matched a dynamic binding. **static permit**: An ARP packet was forwarded because it matched a static binding. In the **ARP Inspection VLAN Configure** screen, you can configure the Switch to generate log messages when ARP packets are discarded or forwarded based on the VLAN ID of the ARP packet. See Section 24.7.2 on page 219.
Time	This field displays when the log message was generated.

24.7 ARP Inspection Configure

Use this screen to enable ARP inspection on the Switch. You can also configure the length of time the Switch stores records of discarded ARP packets and global settings for the ARP inspection log. To open this screen, click **Advanced Application > IP Source Guard > ARP Inspection > Configure**.

Figure 113 Advanced Application > IP Source Guard > ARP Inspection > Configure



The following table describes the labels in this screen.

Table 80 Advanced Application > IP Source Guard > ARP Inspection > Configure

LABEL	DESCRIPTION
Active	Select this to enable ARP inspection on the Switch. You still have to enable ARP inspection on specific VLAN and specify trusted ports.
Filter Aging Time	
Filter aging time	This setting has no effect on existing MAC address filters. Enter how long (1-2147483647 seconds) the MAC address filter remains in the Switch after the Switch identifies an unauthorized ARP packet. The Switch automatically deletes the MAC address filter afterwards. Enter 0 if you want the MAC address filter to be permanent.
Log Profile	
Log buffer size	Enter the maximum number (0-1024) of log messages that were generated by ARP packets and have not been sent to the syslog server yet. Make sure this number is appropriate for the specified **Syslog rate** and **Log interval**. If the number of log messages in the Switch exceeds this number, the Switch stops recording log messages and simply starts counting the number of entries that were dropped due to unavailable buffer. Click **Clearing log status table** in the **ARP Inspection Log Status** screen to clear the log and reset this counter. See Section 24.6.2 on page 215.

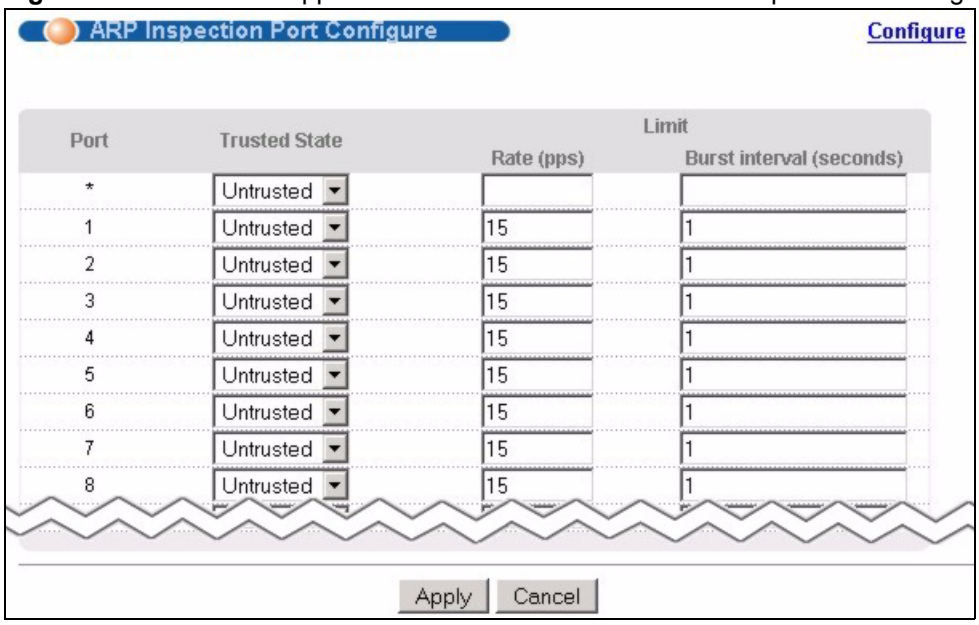
Table 80 Advanced Application > IP Source Guard > ARP Inspection > Configure (continued)

LABEL	DESCRIPTION
Syslog rate	Enter the maximum number of syslog messages the Switch can send to the syslog server in one batch. This number is expressed as a rate because the batch frequency is determined by the **Log Interval**. You must configure the syslog server (Chapter 32 on page 269) to use this. Enter 0 if you do not want the Switch to send log messages generated by ARP packets to the syslog server. The relationship between **Syslog rate** and **Log interval** is illustrated in the following examples: • 4 invalid ARP packets per second, **Syslog rate** is 5, **Log interval** is 1: the Switch sends 4 syslog messages every second. • 6 invalid ARP packets per second, **Syslog rate** is 5, **Log interval** is 2: the Switch sends 10 syslog messages every 2 seconds.
Log interval	Enter how often (0-86400 seconds) the Switch sends a batch of syslog messages to the syslog server. Enter 0 if you want the Switch to send syslog messages immediately. See **Syslog rate** for an example of the relationship between **Syslog rate** and **Log interval**.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click this to reset the values in this screen to their last-saved values.

24.7.1 ARP Inspection Port Configure

Use this screen to specify whether ports are trusted or untrusted ports for ARP inspection. To open this screen, click **Advanced Application > IP Source Guard > ARP Inspection > Configure > Port**.

Figure 114 Advanced Application > IP Source Guard > ARP Inspection > Configure > Port



The following table describes the labels in this screen.

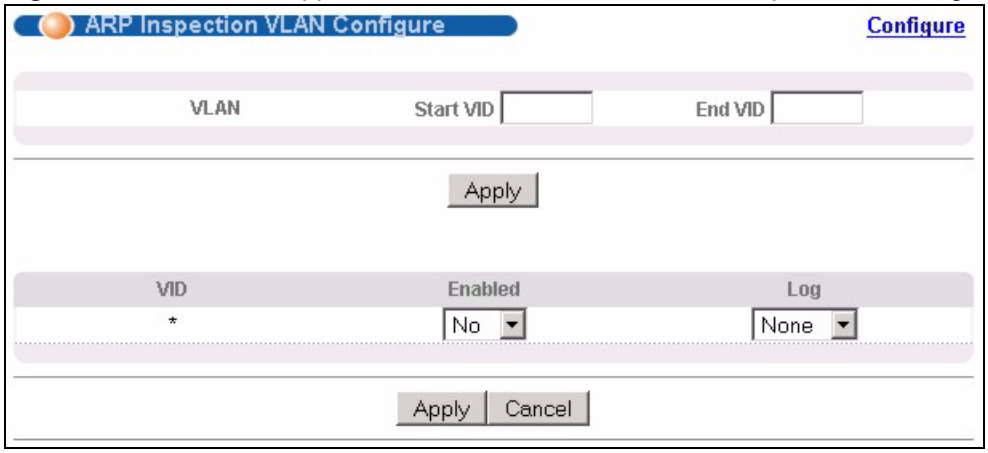
Table 81 Advanced Application > IP Source Guard > ARP Inspection > Configure > Port

LABEL	DESCRIPTION
Port	This field displays the port number. If you configure the * port, the settings are applied to all of the ports.
Trusted State	Select whether this port is a trusted port (**Trusted**) or an untrusted port (**Untrusted**). The Switch does not discard ARP packets on trusted ports for any reason. The Switch discards ARP packets on untrusted ports in the following situations: • The sender's information in the ARP packet does not match any of the current bindings. • The rate at which ARP packets arrive is too high. You can specify the maximum rate at which ARP packets can arrive on untrusted ports.
Limit	These settings have no effect on trusted ports.
Rate (pps)	Specify the maximum rate (0-2048 packets per second) at which the Switch receives ARP packets from each port. The Switch discards any additional ARP packets. Enter 0 to disable this limit.
Burst interval (seconds)	The burst interval is the length of time over which the rate of ARP packets is monitored for each port. For example, if the Rate is 15 pps and the burst interval is 1 second, then the Switch accepts a maximum of 15 ARP packets in every one-second interval. If the burst interval is 5 seconds, then the Switch accepts a maximum of 75 ARP packets in every five-second interval. Enter the length (1-15 seconds) of the burst interval.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click this to reset the values in this screen to their last-saved values.

24.7.2 ARP Inspection VLAN Configure

Use this screen to enable ARP inspection on each VLAN and to specify when the Switch generates log messages for receiving ARP packets from each VLAN. To open this screen, click **Advanced Application > IP Source Guard > ARP Inspection > Configure > VLAN**.

Figure 115 Advanced Application > IP Source Guard > ARP Inspection > Configure > VLAN



The following table describes the labels in this screen.

Table 82 Advanced Application > IP Source Guard > ARP Inspection > Configure > VLAN

LABEL	DESCRIPTION
VLAN	Use this section to specify the VLANs you want to manage in the section below.
Start VID	Enter the lowest VLAN ID you want to manage in the section below.
End VID	Enter the highest VLAN ID you want to manage in the section below.
Apply	Click this to display the specified range of VLANs in the section below.
VID	This field displays the VLAN ID of each VLAN in the range specified above. If you configure the ***** VLAN, the settings are applied to all VLANs.
Enabled	Select **Yes** to enable ARP inspection on the VLAN. Select **No** to disable ARP inspection on the VLAN.
Log	Specify when the Switch generates log messages for receiving ARP packets from the VLAN. **None**: The Switch does not generate any log messages when it receives an ARP packet from the VLAN. **Deny**: The Switch generates log messages when it discards an ARP packet from the VLAN. **Permit**: The Switch generates log messages when it forwards an ARP packet from the VLAN. **All**: The Switch generates log messages every time it receives an ARP packet from the VLAN.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click this to reset the values in this screen to their last-saved values.

25

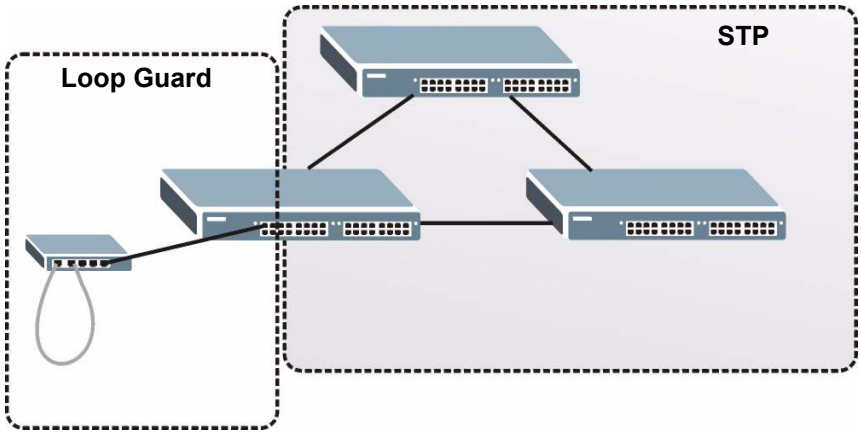
Loop Guard

This chapter shows you how to configure the Switch to guard against loops on the edge of your network.

25.1 Loop Guard Overview

Loop guard allows you to configure the Switch to shut down a port if it detects that packets sent out on that port loop back to the Switch. While you can use Spanning Tree Protocol (STP) to prevent loops in the core of your network. STP cannot prevent loops that occur on the edge of your network.

Figure 116 Loop Guard vs STP



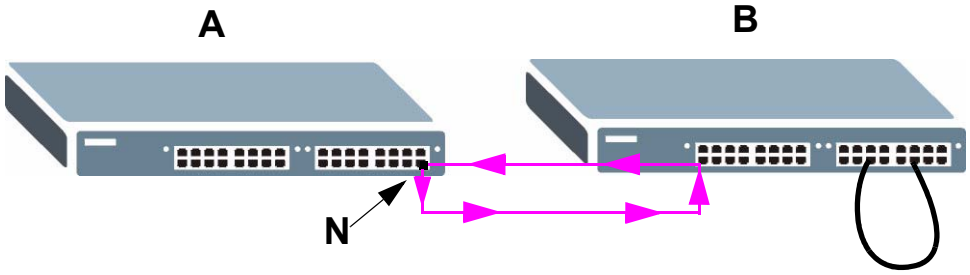
Loop guard is designed to handle loop problems on the edge of your network. This can occur when a port is connected to a switch that is in a loop state. Loop state occurs as a result of human error. It happens when two ports on a switch are connected with the same cable. When a switch in loop state sends out broadcast messages the messages loop back to the switch and are re-broadcast again and again causing a broadcast storm.

If a switch (not in loop state) connects to a switch in loop state, then it will be affected by the switch in loop state in the following way:

- It will receive broadcast messages sent out from the switch in loop state.
- It will receive its own broadcast messages that it sends out as they loop back. It will then re-broadcast those messages again.

The following figure shows port **N** on switch **A** connected to switch **B**. Switch **B** is in loop state. When broadcast or multicast packets leave port **N** and reach switch **B**, they are sent back to port **N** on **A** as they are rebroadcast from B.

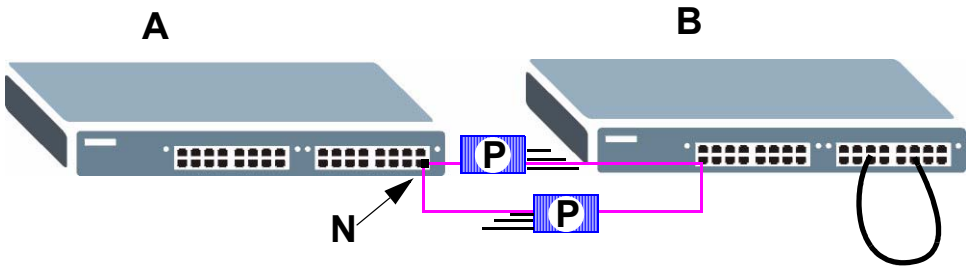
Figure 117 Switch in Loop State



The loop guard feature checks to see if a loop guard enabled port is connected to a switch in loop state. This is accomplished by periodically sending a probe packet and seeing if the packet returns on the same port. If this is the case, the Switch will shut down the port connected to the switch in loop state.

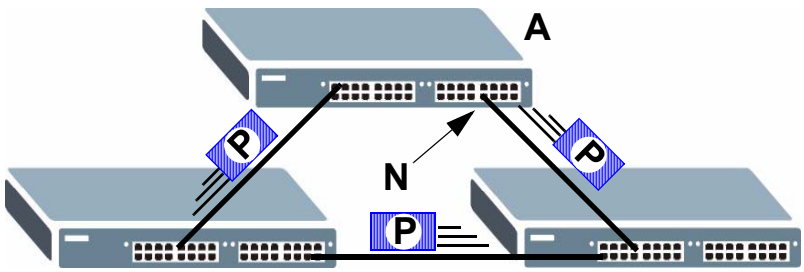
The following figure shows a loop guard enabled port **N** on switch **A** sending a probe packet **P** to switch **B**. Since switch **B** is in loop state, the probe packet **P** returns to port **N** on **A**. The Switch then shuts down port **N** to ensure that the rest of the network is not affected by the switch in loop state.

Figure 118 Loop Guard - Probe Packet



The Switch also shuts down port **N** if the probe packet returns to switch **A** on any other port. In other words loop guard also protects against standard network loops. The following figure illustrates three switches forming a loop. A sample path of the loop guard probe packet is also shown. In this example, the probe packet is sent from port **N** and returns on another port. As long as loop guard is enabled on port **N**. The Switch will shut down port **N** if it detects that the probe packet has returned to the Switch.

Figure 119 Loop Guard - Network Loop



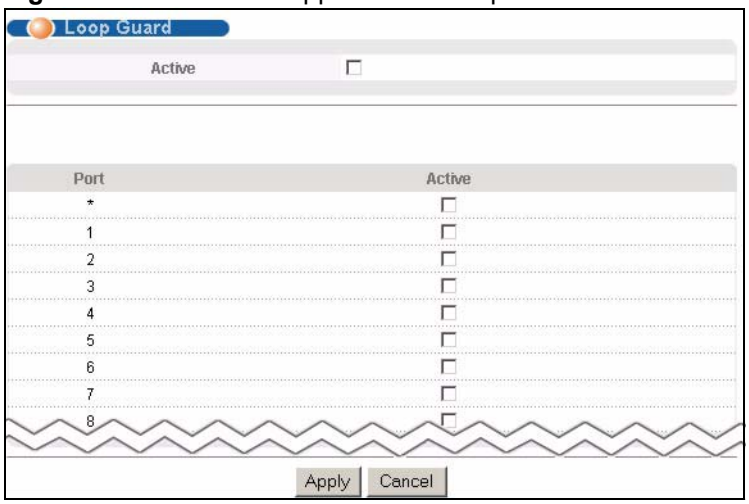
After resolving the loop problem on your network you can re-activate the disabled port via the web configurator (see Section 7.7 on page 84) or via commands (see the CLI Reference Guide).

25.2 Loop Guard Setup

Click **Advanced Application** > **Loop Guard** in the navigation panel to display the screen as shown.

The loop guard feature can not be enabled on the ports that have Spanning Tree Protocol (RSTP, MRSTP or MSTP) enabled.

Figure 120 Advanced Application > Loop Guard



The following table describes the labels in this screen.

Table 83 Advanced Application > Loop Guard

LABEL	DESCRIPTION
Active	Select this option to enable loop guard on the Switch. The Switch generates syslog, internal log messages as well as SNMP traps when it shuts down a port via the loop guard feature.
Port	This field displays a port number.
*	Use this row to make the setting the same for all ports. Use this row first and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.

Table 83 Advanced Application > Loop Guard (continued)

LABEL	DESCRIPTION
Active	Select this check box to enable the loop guard feature on this port. The Switch sends probe packets from this port to check if the Switch it is connected to is in loop state. If the Switch that this port is connected is in loop state the Switch will shut down this port. Clear this check box to disable the loop guard feature.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

26

Static Routing

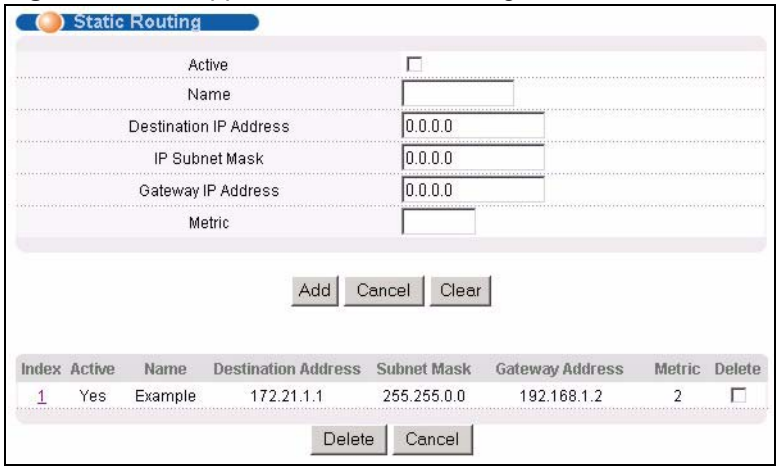
This chapter shows you how to configure static routes.

26.1 Configuring Static Routing

The Switch uses IP for communication with management computers, for example using HTTP, telnet, SSH, or SNMP. Use IP static routes to have the Switch respond to remote management stations that are not reachable through the default gateway. The Switch can also use static routes to send data to a server or device that is not reachable through the default gateway, for example when sending SNMP traps or using ping to test IP connectivity.

Click **IP Application** > **Static Routing** in the navigation panel to display the screen as shown.

Figure 121 IP Application > Static Routing



The following table describes the related labels you use to create a static route.

Table 84 IP Application > Static Routing

LABEL	DESCRIPTION
Active	This field allows you to activate/deactivate this static route.
Name	Enter a descriptive name (up to 10 printable ASCII characters) for identification purposes.
Destination IP Address	This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
IP Subnet Mask	Enter the subnet mask for this destination.

Table 84 IP Application > Static Routing (continued)

LABEL	DESCRIPTION
Gateway IP Address	Enter the IP address of the gateway. The gateway is an immediate neighbor of your Switch that will forward the packet to the destination. The gateway must be a router on the same segment as your Switch.
Metric	The metric represents the “cost” of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. Enter a number that approximates the cost for this link. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number.
Add	Click **Add** to insert a new static route to the Switch’s run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clear	Click **Clear** to set the above fields back to the factory defaults.
Index	This field displays the index number of the route. Click a number to edit the static route entry.
Active	This field displays **Yes** when the static route is activated and **NO** when it is deactivated.
Name	This field displays the descriptive name for this route. This is for identification purpose only.
Destination Address	This field displays the IP network address of the final destination.
Subnet Mask	This field displays the subnet mask for this destination.
Gateway Address	This field displays the IP address of the gateway. The gateway is an immediate neighbor of your Switch that will forward the packet to the destination.
Metric	This field displays the cost of transmission for routing purposes.
Delete	Click **Delete** to remove the selected entry from the summary table.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

27

Differentiated Services

This chapter shows you how to configure Differentiated Services (DiffServ) on the Switch.

27.1 DiffServ Overview

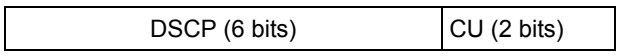
Quality of Service (QoS) is used to prioritize source-to-destination traffic flows. All packets in the flow are given the same priority. You can use CoS (class of service) to give different priorities to different packet types.

DiffServ is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

27.1.1 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (ToS) field in the IP header. The DS field contains a 6-bit DSCP field which can define up to 64 service levels and the remaining 2 bits are defined as currently unused (CU). The following figure illustrates the DS field.

Figure 122 DiffServ: Differentiated Service Field



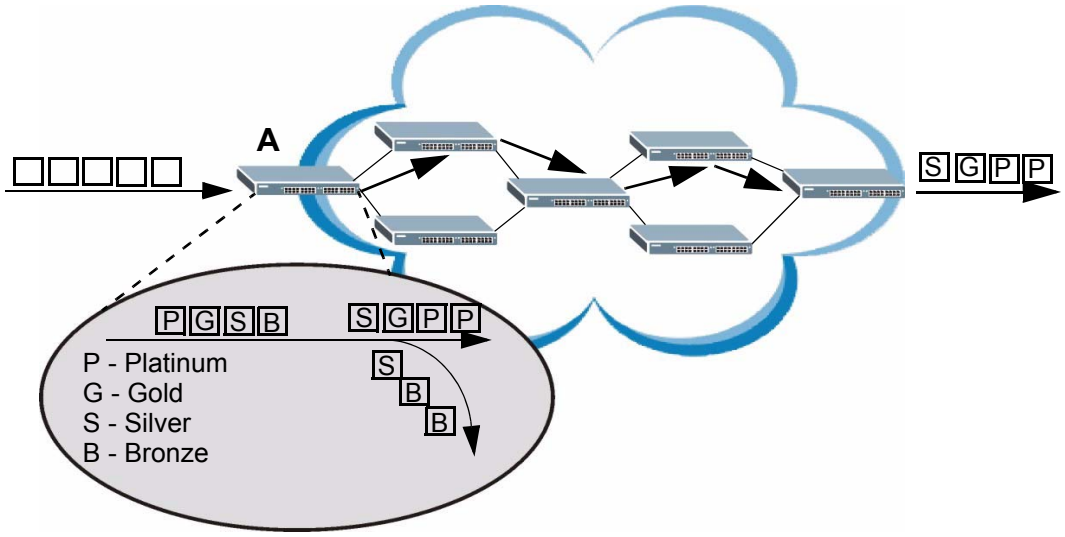
DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

The DSCP value determines the PHB (Per-Hop Behavior), that each packet gets as it is forwarded across the DiffServ network. Based on the marking rule different kinds of traffic can be marked for different priorities of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

27.1.2 DiffServ Network Example

The following figure depicts a DiffServ network consisting of a group of directly connected DiffServ-compliant network devices. The boundary node (**A** in Figure 123) in a DiffServ network classifies (marks with a DSCP value) the incoming packets into different traffic flows (**Platinum**, **Gold**, **Silver**, **Bronze**) based on the configured marking rules. A network administrator can then apply various traffic policies to the traffic flows. An example traffic policy, is to give higher drop precedence to one traffic flow over others. In our example, packets in the **Bronze** traffic flow are more likely to be dropped when congestion occurs than the packets in the **Platinum** traffic flow as they move across the DiffServ network.

Figure 123 DiffServ Network



27.2 Two Rate Three Color Marker Traffic Policing

Traffic policing is the limiting of the input or output transmission rate of a class of traffic on the basis of user-defined criteria. Traffic policing methods measure traffic flows against user-defined criteria and identify it as either conforming, exceeding or violating the criteria.

Two Rate Three Color Marker (TRTCM, defined in RFC 2698) is a type of traffic policing that identifies packets by comparing them to two user-defined rates: the Committed Information Rate (CIR) and the Peak Information Rate (PIR). The CIR specifies the average rate at which packets are admitted to the network. The PIR is greater than or equal to the CIR. CIR and PIR values are based on the guaranteed and maximum bandwidth respectively as negotiated between a service provider and client.

Two Rate Three Color Marker evaluates incoming packets and marks them with one of three colors which refer to packet loss priority levels. High packet loss priority level is referred to as red, medium is referred to as yellow and low is referred to as green. After TRTCM is configured and DiffServ is enabled the following actions are performed on the colored packets:

- Red (high loss priority level) packets are dropped.
- Yellow (medium loss priority level) packets are dropped if there is congestion on the network.

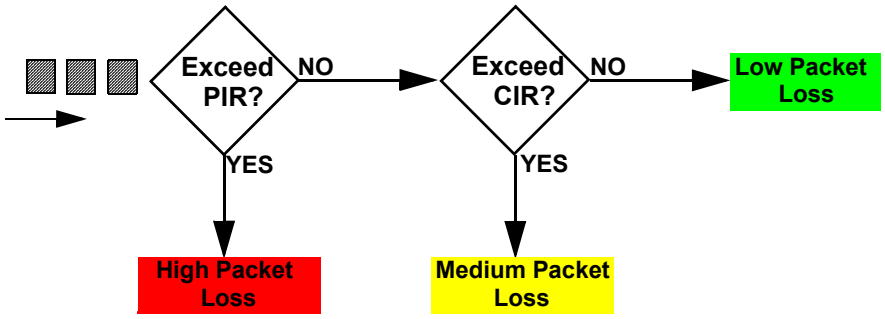
- Green (low loss priority level) packets are forwarded.

TRTCM operates in one of two modes: color-blind or color-aware. In color-blind mode, packets are marked based on evaluating against the PIR and CIR regardless of if they have previously been marked or not. In the color-aware mode, packets are marked based on both existing color and evaluation against the PIR and CIR. If the packets do not match any of colors, then the packets proceed unchanged.

27.2.1 TRTCM - Color-blind Mode

All packets are evaluated against the PIR. If a packet exceeds the PIR it is marked red. Otherwise it is evaluated against the CIR. If it exceeds the CIR then it is marked yellow. Finally, if it is below the CIR then it is marked green.

Figure 124 TRTCM - Color-blind Mode

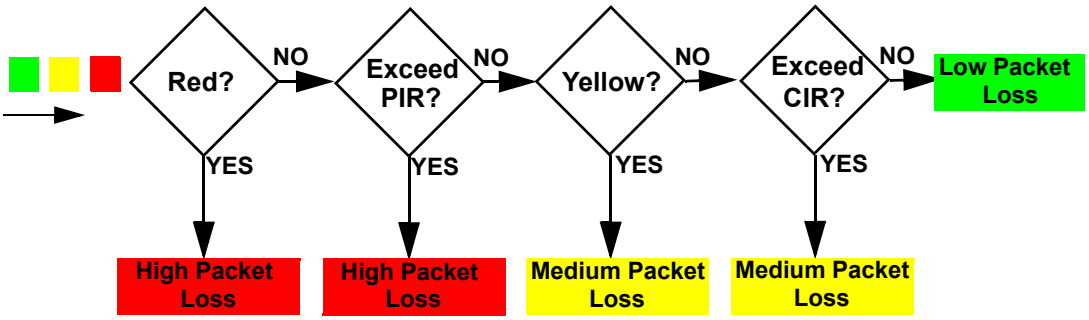


27.2.2 TRTCM - Color-aware Mode

In color-aware mode the evaluation of the packets uses the existing packet loss priority. TRTCM can increase a packet loss priority of a packet but it cannot decrease it. Packets that have been previously marked red or yellow can only be marked with an equal or higher packet loss priority.

Packets marked red (high packet loss priority) continue to be red without evaluation against the PIR or CIR. Packets marked yellow can only be marked red or remain yellow so they are only evaluated against the PIR. Only the packets marked green are first evaluated against the PIR and then if they don't exceed the PIR level are they evaluated against the CIR.

Figure 125 TRTCM - Color-aware Mode

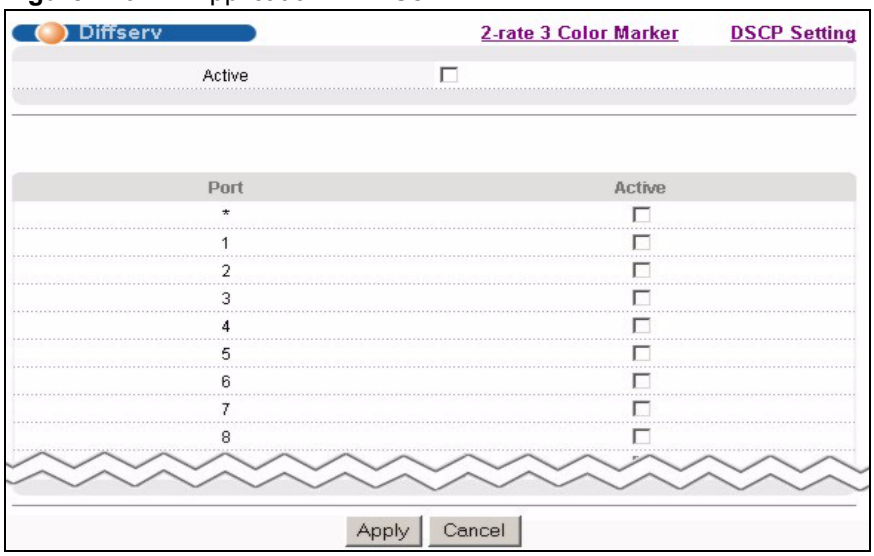


27.3 Activating DiffServ

Activate DiffServ to apply marking rules or IEEE 802.1p priority mapping on the selected port(s).

Click **IP Application** > **DiffServ** in the navigation panel to display the screen as shown.

Figure 126 IP Application > DiffServ



The following table describes the labels in this screen.

Table 85 IP Application > DiffServ

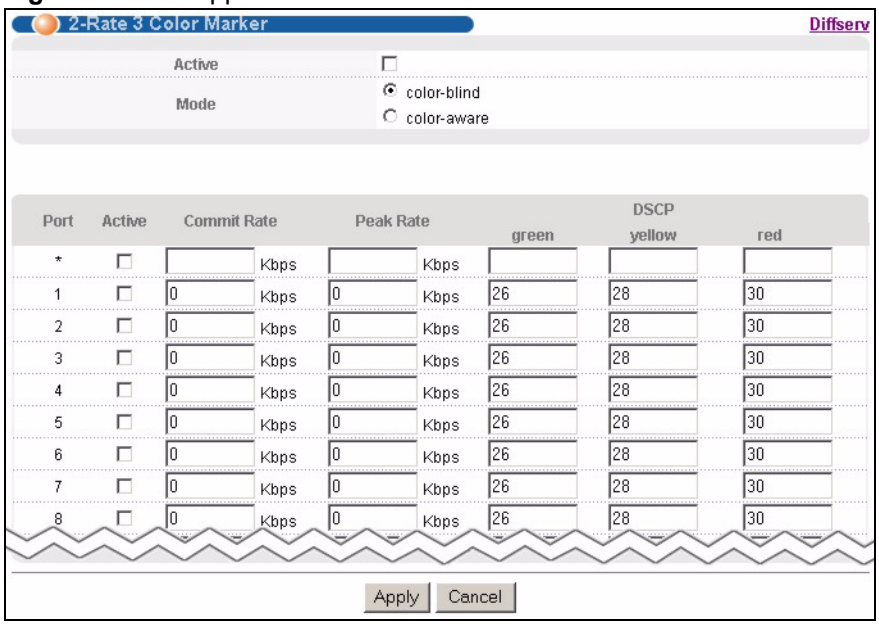
LABEL	DESCRIPTION
Active	Select this option to enable DiffServ on the Switch.
Port	This field displays the index number of a port on the Switch.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select **Active** to enable DiffServ on the port.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

27.3.1 Configuring 2-Rate 3 Color Marker Settings

Use this screen to configure TRTCM settings. Click the **2-rate 3 Color Marker** link in the **DiffServ** screen to display the screen as shown next.

You cannot enable both TRTCM and Bandwidth Control at the same time.

Figure 127 IP Application > DiffServ > 2-rate 3 Color Marker



The following table describes the labels in this screen.

Table 86 IP Application > DiffServ > 2-rate 3 Color Marker

LABEL	DESCRIPTION
Active	Select this to activate TRTCM (Two Rate Three Color Marker) on the Switch. The Switch evaluates and marks the packets based on the TRTCM settings. Note: You must also activate **DiffServ** on the Switch and the individual ports for the Switch to drop red (high loss priority) colored packets.
Mode	Select **color-blind** to have the Switch treat all incoming packets as uncolored. All incoming packets are evaluated against the CIR and PIR. Select **color-aware** to treat the packets as marked by some preceding entity. Incoming packets are evaluated based on their existing color. Incoming packets that are not marked proceed through the Switch.
Port	This field displays the index number of a port on the Switch.
*	Settings in this row apply to all ports. Use this row only if you want to make some settings the same for all ports. Use this row first to set the common settings and then make adjustments on a port-by-port basis. Note: Changes in this row are copied to all the ports as soon as you make them.
Active	Select this to activate TRTCM on the port.
Commit Rate	Specify the Commit Information Rate (CIR) for this port.
Peak Rate	Specify the Peak Information Rate (PIR) for this port.

Table 86 IP Application > DiffServ > 2-rate 3 Color Marker (continued)

LABEL	DESCRIPTION
DSCP	Use this section to specify the DSCP values that you want to assign to packets based on the color they are marked via TRTCM.
green	Specify the DSCP value to use for packets with low packet loss priority.
yellow	Specify the DSCP value to use for packets with medium packet loss priority.
red	Specify the DSCP value to use for packets with high packet loss priority.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

27.4 DSCP-to-IEEE 802.1p Priority Settings

You can configure the DSCP to IEEE 802.1p mapping to allow the Switch to prioritize all traffic based on the incoming DSCP value according to the DiffServ to IEEE 802.1p mapping table.

The following table shows the default DSCP-to-IEEE802.1p mapping.

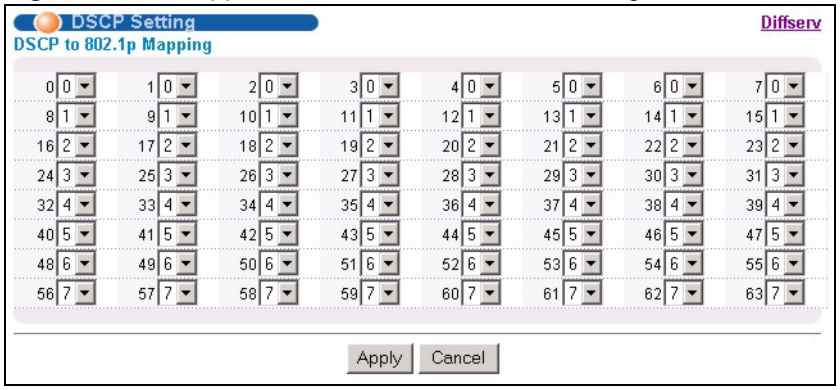
Table 87 Default DSCP-IEEE 802.1p Mapping

DSCP VALUE	0 – 7	8 – 15	16 – 23	24 – 31	32 – 39	40 – 47	48 – 55	56 – 63
IEEE 802.1p	0	1	2	3	4	5	6	7

27.4.1 Configuring DSCP Settings

To change the DSCP-IEEE 802.1p mapping click the **DSCP Setting** link in the **DiffServ** screen to display the screen as shown next.

Figure 128 IP Application > DiffServ > DSCP Setting



The following table describes the labels in this screen.

Table 88 IP Application > DiffServ > DSCP Setting

LABEL	DESCRIPTION
0 … 63	This is the DSCP classification identification number. To set the IEEE 802.1p priority mapping, select the priority level from the drop-down list box.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

28 DHCP

This chapter shows you how to configure the DHCP feature.

28.1 DHCP Overview

DHCP (Dynamic Host Configuration Protocol RFC 2131 and RFC 2132) allows individual computers to obtain TCP/IP configuration at start-up from a server. You can configure the Switch as a DHCP relay agent. If you configure the Switch as a relay agent, then the Switch forwards DHCP requests to DHCP server on your network. If you don't configure the Switch as a relay agent then you must have a DHCP server in the broadcast domain of the client computers or else the client computers must be configured manually.

28.1.1 DHCP Modes

If there is already a DHCP server on your network, then you can configure the Switch as a DHCP relay agent. When the Switch receives a request from a computer on your network, it contacts the DHCP server for the necessary IP information, and then relays the assigned information back to the computer.

28.1.2 DHCP Configuration Options

The DHCP configuration on the Switch is divided into **Global** and **VLAN** screens. The screen you should use for configuration depends on the DHCP services you want to offer the DHCP clients on your network. Choose the configuration screen based on the following criteria:

- **Global** - The Switch forwards all DHCP requests to the same DHCP server.
- **VLAN** - The Switch is configured on a VLAN by VLAN basis. The Switch can relay DHCP requests from different VLAN to different DHCP servers.

28.2 DHCP Status

Click **IP Application** > **DHCP** in the navigation panel. The **DHCP Status** screen displays.

Figure 129 IP Application > DHCP Status



The following table describes the labels in this screen.

Table 89 IP Application > DHCP Status

LABEL	DESCRIPTION
Relay Status	This section displays configuration settings related to the Switch's DHCP relay mode.
Relay Mode	This field displays: • **None** - if the Switch is not configured as a DHCP relay agent. • **Global** - if the Switch is configured as a DHCP relay agent only. • **VLAN** - followed by a VLAN ID if it is configured as a relay agent for specific VLAN(s).

28.3 DHCP Relay

Configure DHCP relay on the Switch if the DHCP clients and the DHCP server are not in the same broadcast domain. During the initial IP address leasing, the Switch helps to relay network information (such as the IP address and subnet mask) between a DHCP client and a DHCP server. Once the DHCP client obtains an IP address and can connect to the network, network information renewal is done between the DHCP client and the DHCP server without the help of the Switch.

The Switch can be configured as a global DHCP relay. This means that the Switch forwards all DHCP requests from all domains to the same DHCP server. You can also configure the Switch to relay DHCP information based on the VLAN membership of the DHCP clients.

28.3.1 DHCP Relay Agent Information

The Switch can add information about the source of client DHCP requests that it relays to a DHCP server by adding **Relay Agent Information**. This helps provide authentication about the source of the requests. The DHCP server can then provide an IP address based on this information. Please refer to RFC 3046 for more details.

The DHCP **Relay Agent Information** feature adds an Agent Information field to the **Option 82** field. The **Option 82** field is in the DHCP headers of client DHCP request frames that the Switch relays to a DHCP server.

Relay Agent Information can include the **System Name** of the Switch if you select this option. You can change the **System Name** in **Basic Settings** > **General Setup**.

The following describes the DHCP relay information that the Switch sends to the DHCP server:

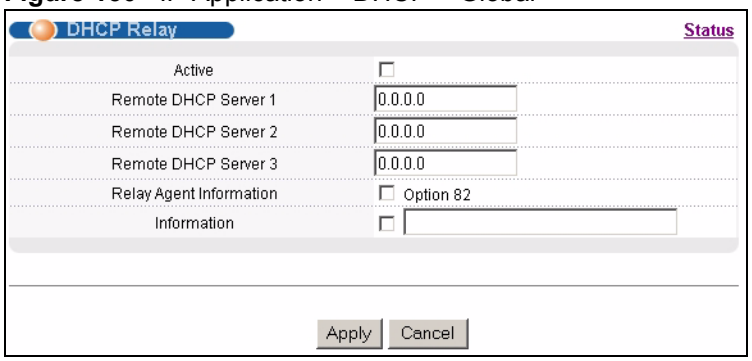
Table 90 Relay Agent Information

FIELD LABELS	DESCRIPTION
Slot ID	(1 byte) This value is always 0 for stand-alone switches.
Port ID	(1 byte) This is the port that the DHCP client is connected to.
VLAN ID	(2 bytes) This is the VLAN that the port belongs to.
Information	(up to 64 bytes) This optional, read-only field is set according to system name set in **Basic Settings > General Setup.**

28.3.2 Configuring DHCP Global Relay

Configure global DHCP relay in the **DHCP Relay** screen. Click **IP Application > DHCP** in the navigation panel and click the **Global** link to display the screen as shown.

Figure 130 IP Application > DHCP > Global



The following table describes the labels in this screen.

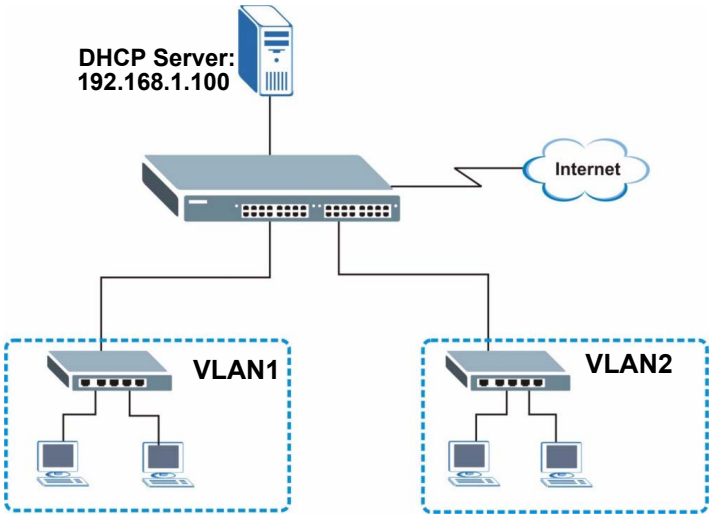
Table 91 IP Application > DHCP > Global

LABEL	DESCRIPTION
Active	Select this check box to enable DHCP relay.
Remote DHCP Server 1 .. 3	Enter the IP address of a DHCP server in dotted decimal notation.
Relay Agent Information	Select the **Option 82** check box to have the Switch add information (slot number, port number and VLAN ID) to client DHCP requests that it relays to a DHCP server.
Information	This read-only field displays the system name you configure in the **General Setup** screen. Select the check box for the Switch to add the system name to the client DHCP requests that it relays to a DHCP server.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

28.3.3 Global DHCP Relay Configuration Example

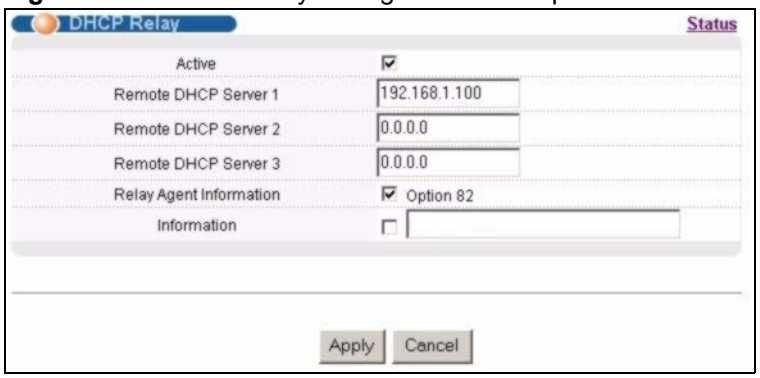
The follow figure shows a network example where the Switch is used to relay DHCP requests for the **VLAN1** and **VLAN2** domains. There is only one DHCP server that services the DHCP clients in both domains.

Figure 131 Global DHCP Relay Network Example



Configure the **DHCP Relay** screen as shown. Make sure you select the **Option 82** check box to set the Switch to send additional information (such as the VLAN ID) together with the DHCP requests to the DHCP server. This allows the DHCP server to assign the appropriate IP address according to the VLAN ID.

Figure 132 DHCP Relay Configuration Example

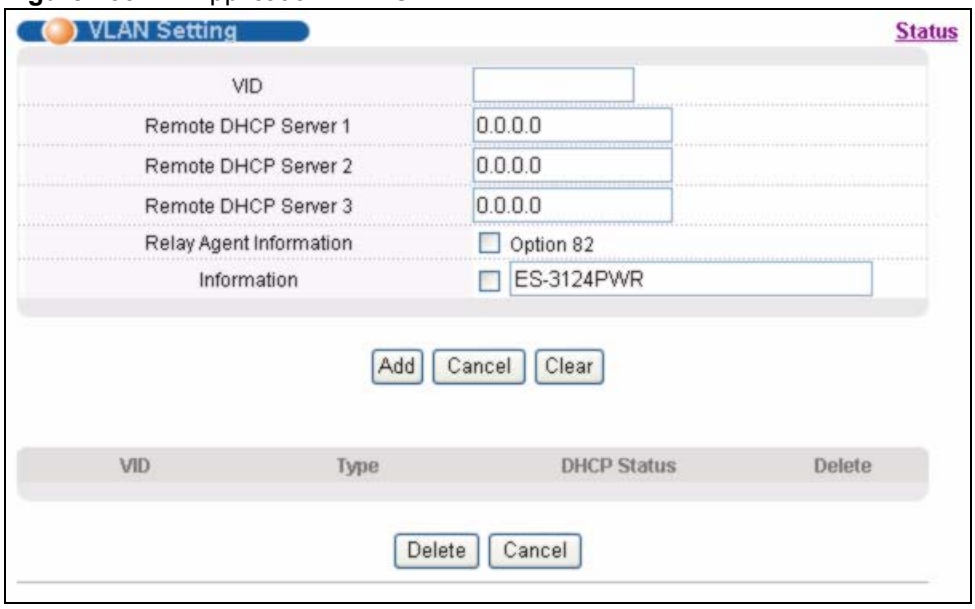


28.4 Configuring DHCP VLAN Settings

Use this screen to configure your DHCP settings based on the VLAN domain of the DHCP clients. Click **IP Application** > **DHCP** in the navigation panel, then click the **VLAN** link In the **DHCP Status** screen that displays.

You must set up a management IP address for each VLAN that you want to configure DHCP settings for on the Switch. See Section 7.6 on page 82 for information on how to do this.

Figure 133 IP Application > DHCP > VLAN



The following table describes the labels in this screen.

Table 92 IP Application > DHCP > VLAN

LABEL	DESCRIPTION
VID	Enter the ID number of the VLAN to which these DHCP settings apply.
Remote DHCP Server 1 .. 3	Enter the IP address of a DHCP server in dotted decimal notation.
Relay Agent Information	Select the **Option 82** check box to have the Switch add information (slot number, port number and VLAN ID) to client DHCP requests that it relays to a DHCP server.
Information	This read-only field displays the system name you configure in the **General Setup** screen. Select the check box for the Switch to add the system name to the client DHCP requests that it relays to a DHCP server.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clear	Click this to clear the fields above.
VID	This field displays the ID number of the VLAN group to which this DHCP settings apply.
Type	This field displays **Relay** for the DHCP mode.
DHCP Status	For DHCP relay configuration, this field displays the first remote DHCP server IP address.

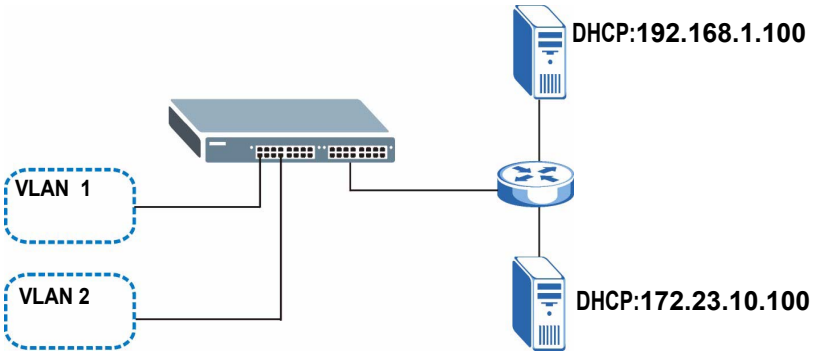
Table 92 IP Application > DHCP > VLAN (continued)

LABEL	DESCRIPTION
Delete	Select the configuration entries you want to remove and click **Delete** to remove them.
Cancel	Click **Cancel** to clear the **Delete** check boxes.

28.4.1 Example: DHCP Relay for Two VLANs

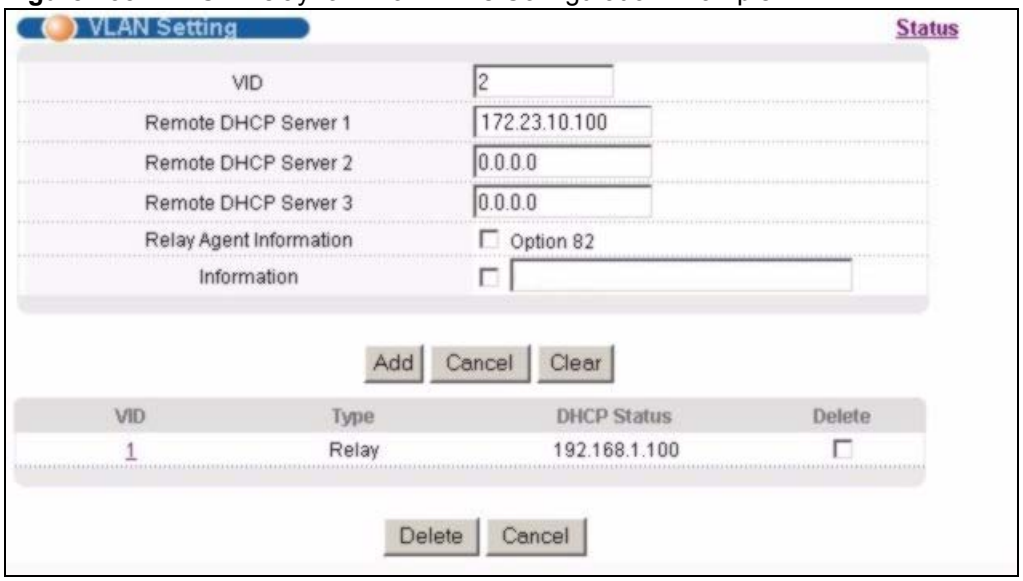
The following example displays two VLANs (VIDs 1 and 2) for a campus network. Two DHCP servers are installed to serve each VLAN. The system is set up to forward DHCP requests from the dormitory rooms (VLAN 1) to the DHCP server with an IP address of 192.168.1.100. Requests from the academic buildings (VLAN 2) are sent to the other DHCP server with an IP address of 172.23.10.100.

Figure 134 DHCP Relay for Two VLANs



For the example network, configure the **VLAN Setting** screen as shown.

Figure 135 DHCP Relay for Two VLANs Configuration Example



29

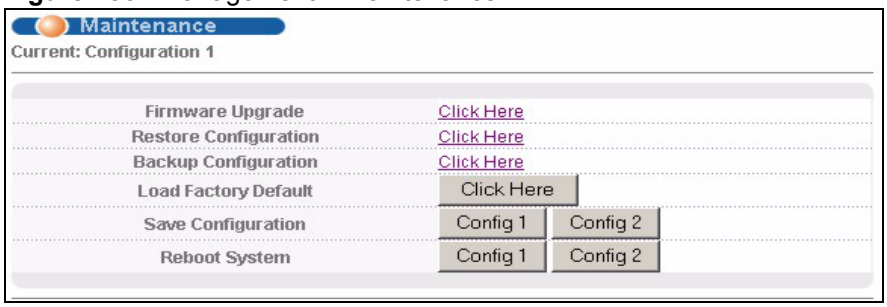
Maintenance

This chapter explains how to configure the maintenance screens that let you maintain the firmware and configuration files.

29.1 The Maintenance Screen

Use this screen to manage firmware and your configuration files. Click **Management** > **Maintenance** in the navigation panel to open the following screen.

Figure 136 Management > Maintenance



The following table describes the labels in this screen.

Table 93 Management > Maintenance

LABEL	DESCRIPTION
Current	This field displays which configuration (**Configuration 1** or **Configuration 2**) is currently operating on the Switch.
Firmware Upgrade	Click **Click Here** to go to the **Firmware Upgrade** screen.
Restore Configuration	Click **Click Here** to go to the **Restore Configuration** screen.
Backup Configuration	Click **Click Here** to go to the **Backup Configuration** screen.
Load Factory Default	Click **Click Here** to reset the configuration to the factory default settings.

Table 93 Management > Maintenance (continued)

LABEL	DESCRIPTION
Save Configuration	Click **Config 1** to save the current configuration settings to **Configuration 1** on the Switch. Click **Config 2** to save the current configuration settings to **Configuration 2** on the Switch.
Reboot System	Click **Config 1** to reboot the system and load **Configuration 1** on the Switch. Click **Config 2** to reboot the system and load **Configuration 2** on the Switch. Note: Make sure to click the **Save** button in any screen to save your settings to the current configuration on the Switch.

29.2 Load Factory Default

Follow the steps below to reset the Switch back to the factory defaults.

1. In the **Maintenance** screen, click the **Click Here** button next to **Load Factory Default** to clear all Switch configuration information you configured and return to the factory defaults.
2. Click **OK** to reset all Switch configurations to the factory defaults.

Figure 137 Load Factory Default: Start



3. In the web configurator, click the **Save** button to make the changes take effect. If you want to access the Switch web configurator again, you may need to change the IP address of your computer to be in the same subnet as that of the default Switch IP address (192.168.1.1).

29.3 Save Configuration

Click **Config 1** to save the current configuration settings permanently to **Configuration 1** on the Switch.

Click **Config 2** to save the current configuration settings to **Configuration 2** on the Switch.

Alternatively, click Save on the top right-hand corner in any screen to save the configuration changes to the current configuration.

Clicking the **Apply** or **Add** button does NOT save the changes permanently. All unsaved changes are erased after you reboot the Switch.

29.4 Reboot System

Reboot System allows you to restart the Switch without physically turning the power off. It also allows you to load configuration one (**Config 1**) or configuration two (**Config 2**) when you reboot. Follow the steps below to reboot the Switch.

1 In the **Maintenance** screen, click the **Config 1** button next to **Reboot System** to reboot and load configuration one. The following screen displays.

Figure 138 Reboot System: Confirmation



2 Click **OK** again and then wait for the Switch to restart. This takes up to two minutes. This does not affect the Switch's configuration.

Click **Config 2** and follow steps 1 to 2 to reboot and load configuration two on the Switch.

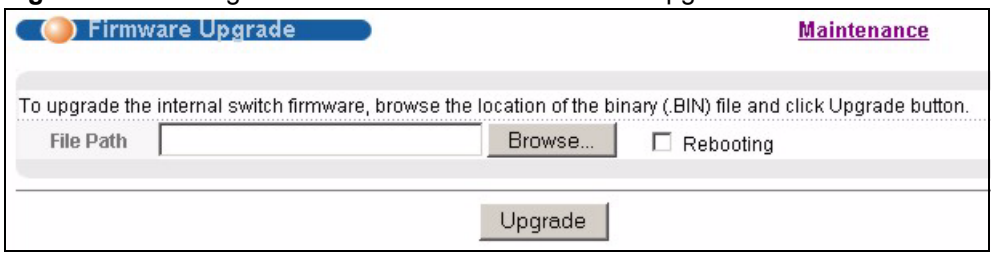
29.5 Firmware Upgrade

Make sure you have downloaded (and unzipped) the correct model firmware and version to your computer before uploading to the device.

Be sure to upload the correct model firmware as uploading the wrong model firmware may damage your device.

From the **Maintenance** screen, display the **Firmware Upgrade** screen as shown next.

Figure 139 Management > Maintenance > Firmware Upgrade



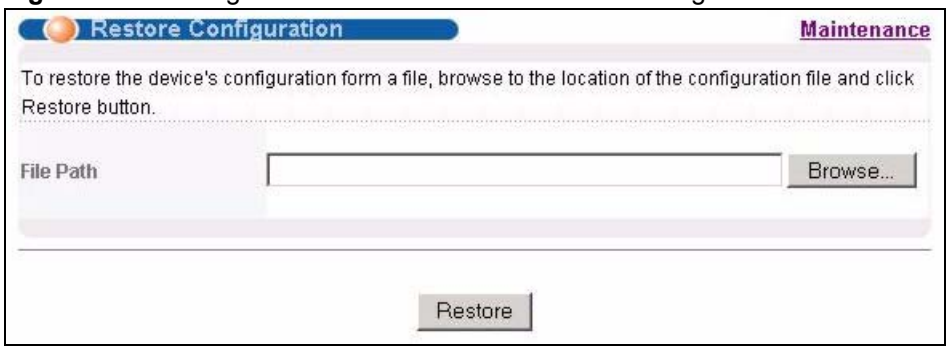
Type the path and file name of the firmware file you wish to upload to the Switch in the **File Path** text box or click **Browse** to locate it. Select the **Rebooting** check box if you want to reboot the Switch and apply the new firmware immediately. (Firmware upgrades are only applied after a reboot). Click **Upgrade** to load the new firmware.

After the firmware upgrade process is complete, see the **System Info** screen to verify your current firmware version number.

29.6 Restore a Configuration File

Restore a previously saved configuration from your computer to the Switch using the **Restore Configuration** screen.

Figure 140 Management > Maintenance > Restore Configuration


Restore Configuration
Maintenance
To restore the device's configuration form a file, browse to the location of the configuration file and click Restore button.
File Path
Browse...
Restore

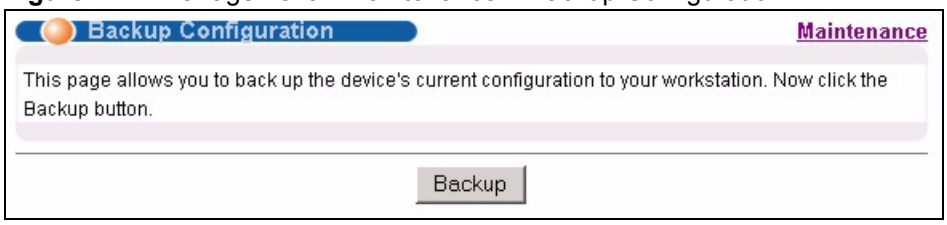
Type the path and file name of the configuration file you wish to restore in the **File Path** text box or click **Browse** to locate it. After you have specified the file, click **Restore**. "config" is the name of the configuration file on the Switch, so your backup configuration file is automatically renamed when you restore using this screen.

29.7 Backup a Configuration File

Backing up your Switch configurations allows you to create various “snap shots” of your device from which you may restore at a later date.

Back up your current Switch configuration to a computer using the **Backup Configuration** screen.

Figure 141 Management > Maintenance > Backup Configuration


Backup Configuration
Maintenance
This page allows you to back up the device's current configuration to your workstation. Now click the Backup button.
Backup

Follow the steps below to back up the current Switch configuration to your computer in this screen.

1. Click **Backup**.
2. Click **Save** to display the **Save As** screen.
3. Choose a location to save the file on your computer from the **Save in** drop-down list box and type a descriptive name for it in the **File name** list box. Click **Save** to save the configuration file to your computer.

29.8 FTP Command Line

This section shows some examples of uploading to or downloading files from the Switch using FTP commands. First, understand the filename conventions.

29.8.1 Filename Conventions

The configuration file (also known as the romfile or ROM) contains the factory default settings in the screens such as password, Switch setup, IP Setup, and so on. Once you have customized the Switch's settings, they can be saved back to your computer under a filename of your choosing.

ZyNOS (ZyXEL Network Operating System sometimes referred to as the "ras" file) is the system firmware and has a "bin" filename extension.

Table 94 Filename Conventions

FILE TYPE	INTERNAL NAME	EXTERNAL NAME	DESCRIPTION
Configuration File	config		This is the configuration filename on the Switch. Uploading the config file replaces the specified configuration file system, including your Switch configurations, system-related data (including the default password), the error log and the trace log.
Firmware	ras	*.bin	This is the generic name for the ZyNOS firmware on the Switch.

29.8.1.1 Example FTP Commands

```
ftp> put firmware.bin ras
```

This is a sample FTP session showing the transfer of the computer file "firmware.bin" to the Switch.

```
ftp> get config config.cfg
```

This is a sample FTP session saving the current configuration to a file called "config.cfg" on your computer.

If your (T)FTP client does not allow you to have a destination filename different than the source, you will need to rename them as the Switch only recognizes "config" and "ras". Be sure you keep unaltered copies of both files for later use.



Be sure to upload the correct model firmware as uploading the wrong model firmware may damage your device.

29.8.2 FTP Command Line Procedure

1. Launch the FTP client on your computer.
2. Enter `open`, followed by a space and the IP address of your Switch.
3. Press [ENTER] when prompted for a username.
4. Enter your password as requested (the default is "1234").

5 Enter `bin` to set transfer mode to binary.
6 Use `put` to transfer files from the computer to the Switch, for example, `put firmware.bin ras` transfers the firmware on your computer (firmware.bin) to the Switch and renames it to "ras". Similarly, `put config.cfg config` transfers the configuration file on your computer (config.cfg) to the Switch and renames it to "config". Likewise `get config config.cfg` transfers the configuration file on the Switch to your computer and renames it to "config.cfg". See Table 94 on page 245 for more information on filename conventions.
7 Enter `quit` to exit the ftp prompt.

29.8.3 GUI-based FTP Clients

The following table describes some of the commands that you may see in GUI-based FTP clients.

Table 95 General Commands for GUI-based FTP Clients

COMMAND	DESCRIPTION
Host Address	Enter the address of the host server.
Login Type	Anonymous. This is when a user I.D. and password is automatically supplied to the server for anonymous access. Anonymous logins will work only if your ISP or service administrator has enabled this option. Normal. The server requires a unique User ID and Password to login.
Transfer Type	Transfer files in either ASCII (plain text format) or in binary mode. Configuration and firmware files should be transferred in binary mode.
Initial Remote Directory	Specify the default remote directory (path).
Initial Local Directory	Specify the default local directory (path).

29.8.4 FTP Restrictions

FTP will not work when:

- FTP service is disabled in the **Service Access Control** screen.
- The IP address(es) in the **Remote Management** screen does not match the client IP address. If it does not match, the Switch will disconnect the FTP session immediately.

30

Access Control

This chapter describes how to control access to the Switch.

30.1 Access Control Overview

A console port and FTP are allowed one session each, Telnet and SSH share four sessions, up to five Web sessions (five different user names and passwords) and/or limitless SNMP access control sessions are allowed.

Table 96 Access Control Overview

Console Port	SSH	Telnet	FTP	Web	SNMP
One session	Share up to four sessions		One session	Up to five accounts	No limit

A console port access control session and Telnet access control session cannot coexist when multi-login is disabled. See the CLI Reference Guide for more information on disabling multi-login.

30.2 The Access Control Main Screen

Click **Management** > **Access Control** in the navigation panel to display the main screen as shown.

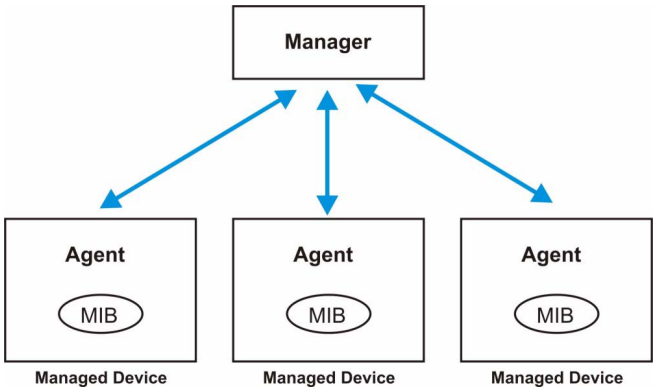
Figure 142 Management > Access Control



30.3 About SNMP

Simple Network Management Protocol (SNMP) is an application layer protocol used to manage and monitor TCP/IP-based devices. SNMP is used to exchange management information between the network management system (NMS) and a network element (NE). A manager station can manage and monitor the Switch through the network via SNMP version one (SNMPv1), SNMP version 2c or SNMP version 3. The next figure illustrates an SNMP management operation. SNMP is only available if TCP/IP is configured.

Figure 143 SNMP Management Model



An SNMP managed network consists of two main components: agents and a manager.

An agent is a management software module that resides in a managed Switch (the Switch). An agent translates the local management information from the managed Switch into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a Switch. Examples of variables include number of packets received, node port status and so on. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

Table 97 SNMP Commands

COMMAND	DESCRIPTION
Get	Allows the manager to retrieve an object variable from the agent.
GetNext	Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
Set	Allows the manager to set values for object variables within an agent.
Trap	Used by the agent to inform the manager of some events.

30.3.1 SNMP v3 and Security

SNMP v3 enhances security for SNMP management. SNMP managers can be required to authenticate with agents before conducting SNMP management sessions.

Security can be further enhanced by encrypting the SNMP messages sent from the managers. Encryption protects the contents of the SNMP messages. When the contents of the SNMP messages are encrypted, only the intended recipients can read them.

30.3.2 Supported MIBs

MIBs let administrators collect statistics and monitor status and performance.

The Switch supports the following MIBs:

- SNMP MIB II (RFC 1213)
- RFC 1157 SNMP v1
- RFC 1493 Bridge MIBs
- RFC 1643 Ethernet MIBs
- RFC 1155 SMI
- RFC 2674 SNMPv2, SNMPv2c
- RFC 1757 RMON
- SNMPv2, SNMPv2c or later version, compliant with RFC 2011 SNMPv2 MIB for IP, RFC 2012 SNMPv2 MIB for TCP, RFC 2013 SNMPv2 MIB for UDP

30.3.3 SNMP Traps

The Switch sends traps to an SNMP manager when an event occurs. The following tables outline the SNMP traps by category.

An OID (Object ID) that begins with "**1.3.6.1.4.1.890.1.5**" is defined in private MIBs. Otherwise, it is a standard MIB OID.

In private MIBs, the OID for each model begins with the values in Table 98 on page 249.

Table 98 Object ID by Model

MODEL	OBJECT ID (BEGINNING)
ES-3124	1.3.6.1.4.1.890.1.5.**8.12**
ES-3124PWR	1.3.6.1.4.1.890.1.5.**8.14**
ES-3124-4F	1.3.6.1.4.1.890.1.5.**8.26**
ES-3124F	1.3.6.1.4.1.890.1.5.**8.31**

Table 99 SNMP System Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
coldstart	coldStart	1.3.6.1.6.3.1.1.5.1	This trap is sent when the Switch is turned on.
warmstart	warmStart	1.3.6.1.6.3.1.1.5.2	This trap is sent when the Switch restarts.

Table 99 SNMP System Traps (continued)

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
fanspeed	FanSpeedEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when the fan speed goes above or below the normal operating range.
	FanSpeedEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when the fan speed returns to the normal operating range.
temperature	TemperatureEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when the temperature goes above or below the normal operating range.
	TemperatureEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when the temperature returns to the normal operating range.
voltage	VoltageEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when the voltage goes above or below the normal operating range.
	VoltageEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when the voltage returns to the normal operating range.

Table 99 SNMP System Traps (continued)

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
reset	UncontrolledResetEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when the Switch automatically resets.
	ControlledResetEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when the Switch resets by an administrator through a management interface.
	RebootEvent	1.3.6.1.4.1.890.1.5.0.1	This trap is sent when the Switch reboots by an administrator through a management interface.
timesync	RTCNotUpdatedEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when the Switch fails to get the time and date from a time server.
	RTCNotUpdatedEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when the Switch gets the time and date from a time server.
intrusionlock	IntrusionLockEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when intrusion lock occurs on a port.
loopguard	LoopguardEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when loopguard shuts down a port.

Table 100 SNMP Interface Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
linkup	linkUp	1.3.6.1.6.3.1.1.5.4	This trap is sent when the Ethernet link is up.
	LinkDownEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when the Ethernet link is up.
linkdown	linkDown	1.3.6.1.6.3.1.1.5.3	This trap is sent when the Ethernet link is down.
	LinkDownEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when the Ethernet link is down.
autonegotiation	AutonegotiationFailedEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when an Ethernet interface fails to auto-negotiate with the peer Ethernet interface.
	AutonegotiationFailedEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when an Ethernet interface auto-negotiates with the peer Ethernet interface.

Table 101 AAA Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
authentication	authenticationFailure	1.3.6.1.6.3.1.1.5.5	This trap is sent when authentication fails due to incorrect user name and/or password.
	AuthenticationFailureEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when authentication fails due to incorrect user name and/or password.
	RADIUSNotReachableEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when there is no response message from the RADIUS server.
	RADIUSNotReachableEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when the RADIUS server can be reached.
accounting	RADIUSNotReachableEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when there is no response message from the RADIUS accounting server.
	RADIUSNotReachableEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when the RADIUS accounting server can be reached.

Table 102 SNMP IP Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
ping	pingProbeFailed	1.3.6.1.2.1.80.0.1	This trap is sent when a single ping probe fails.
	pingTestFailed	1.3.6.1.2.1.80.0.2	This trap is sent when a ping test (consisting of a series of ping probes) fails.
	pingTestCompleted	1.3.6.1.2.1.80.0.3	This trap is sent when a ping test is completed.
traceroute	traceRoutePathChange	1.3.6.1.2.1.81.0.1	This trap is sent when a path to a target changes.
	traceRouteTestFailed	1.3.6.1.2.1.81.0.2	This trap is sent when a traceroute test fails.
	traceRouteTestCompleted	1.3.6.1.2.1.81.0.3	This trap is sent when a traceroute test is completed.

Table 103 SNMP Switch Traps

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
stp	STPNewRoot	1.3.6.1.2.1.17.0.1	This trap is sent when the STP root switch changes.
	MRSTPNewRoot	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.36.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.36.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.36.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.36.2.1	This trap is sent when the MRSTP root switch changes.
	MSTPNewRoot	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.107.70.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.107.70.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.107.70.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.107.70.1	This trap is sent when the MSTP root switch changes.
	STPTopologyChange	1.3.6.1.2.1.17.0.2	This trap is sent when the STP topology changes.
	MRSTPTopologyChange	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.36.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.36.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.36.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.36.2.2	This trap is sent when the MRSTP topology changes.
	MSTPTopologyChange	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.107.70.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.107.70.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.107.70.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.107.70.2	This trap is sent when the MSTP root switch changes.

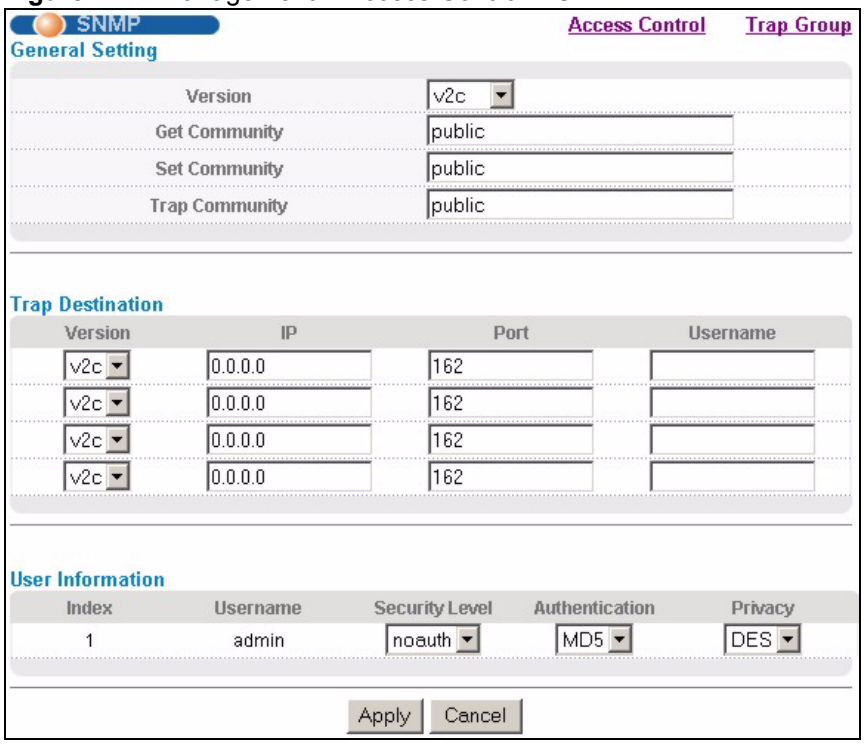
Table 103 SNMP Switch Traps (continued)

OPTION	OBJECT LABEL	OBJECT ID	DESCRIPTION
mactable	MacTableFullEventOn	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.1 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.1 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.1 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.1	This trap is sent when more than 99% of the MAC table is used.
	MacTableFullEventClear	ES-3124: 1.3.6.1.4.1.890.1.5.8.12.27.2.2 ES-3124 PWR: 1.3.6.1.4.1.890.1.5.8.14.27.2.2 ES-3124-4F: 1.3.6.1.4.1.890.1.5.8.26.32.2.2 ES-3124F: 1.3.6.1.4.1.890.1.5.8.31.32.2.2	This trap is sent when less than 95% of the MAC table is used.
rmon	RmonRisingAlarm	1.3.6.1.2.1.16.0.1	This trap is sent when a variable goes over the RMON "rising" threshold.
	RmonFallingAlarm	1.3.6.1.2.1.16.0.2	This trap is sent when the variable falls below the RMON "falling" threshold.

30.3.4 Configuring SNMP

From the **Access Control** screen, display the **SNMP** screen. You can click **Access Control** to go back to the **Access Control** screen.

Figure 144 Management > Access Control > SNMP



The following table describes the labels in this screen.

Table 104 Management > Access Control > SNMP

LABEL	DESCRIPTION
General Setting	Use this section to specify the SNMP version and community (password) values.
Version	Select the SNMP version for the Switch. The SNMP version on the Switch must match the version on the SNMP manager. Choose SNMP version 2c (**v2c**), SNMP version 3 (**v3**) or both (**v3v2c**). Note: SNMP version 2c is backwards compatible with SNMP version 1.
Get Community	Enter the **Get Community** string, which is the password for the incoming Get- and GetNext- requests from the management station. The **Get Community** string is only used by SNMP managers using SNMP version 2c or lower.
Set Community	Enter the **Set Community**, which is the password for incoming Set- requests from the management station. The **Set Community** string is only used by SNMP managers using SNMP version 2c or lower.
Trap Community	Enter the **Trap Community** string, which is the password sent with each trap to the SNMP manager. The **Trap Community** string is only used by SNMP managers using SNMP version 2c or lower.
Trap Destination	Use this section to configure where to send SNMP traps from the Switch.
Version	Specify the version of the SNMP trap messages.
IP	Enter the IP addresses of up to four managers to send your SNMP traps to.
Port	Enter the port number upon which the manager listens for SNMP traps.
Username	Enter the username to be sent to the SNMP manager along with the SNMP v3 trap. Note: This username must match an existing account on the Switch (configured in **Management > Access Control > Logins** screen).
User Information	Use this section to configure users for authentication with managers using SNMP v3. Note: Use the username and password of the login accounts you specify in this section to create accounts on the SNMP v3 manager.
Index	This is a read-only number identifying a login account on the Switch.
Username	This field displays the username of a login account on the Switch.

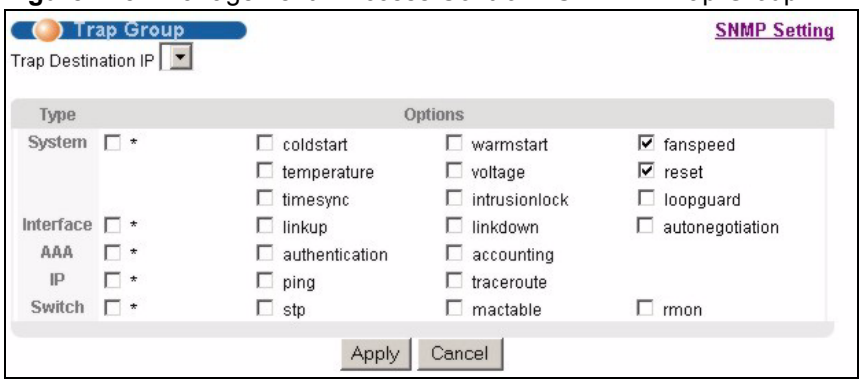
Table 104 Management > Access Control > SNMP (continued)

LABEL	DESCRIPTION
Security Level	Select whether you want to implement authentication and/or encryption for SNMP communication from this user. Choose: • **noauth** -to use the username as the password string to send to the SNMP manager. This is equivalent to the Get, Set and Trap Community in SNMP v2c. This is the lowest security level. • **auth** - to implement an authentication algorithm for SNMP messages sent by this user. • **priv** - to implement authentication and encryption for SNMP messages sent by this user. This is the highest security level. Note: The settings on the SNMP manager must be set at the same security level or higher than the security level settings on the Switch.
Authentication	Select an authentication algorithm. MD5 (Message Digest 5) and SHA (Secure Hash Algorithm) are hash algorithms used to authenticate SNMP data. SHA authentication is generally considered stronger than MD5, but is slower.
Privacy	Specify the encryption method for SNMP communication from this user. You can choose one of the following: • **DES** - Data Encryption Standard is a widely used (but breakable) method of data encryption. It applies a 56-bit key to each 64-bit block of data. • **AES** - Advanced Encryption Standard is another method for data encryption that also uses a secret key. AES applies a 128-bit key to 128-bit blocks of data.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

30.3.5 Configuring SNMP Trap Group

From the **SNMP** screen, click **Trap Group** to view the screen as shown. Use the **Trap Group** screen to specify the types of SNMP traps that should be sent to each SNMP manager.

Figure 145 Management > Access Control > SNMP > Trap Group



The following table describes the labels in this screen.

Table 105 Management > Access Control > SNMP > Trap Group

LABEL	DESCRIPTION
Trap Destination IP	Select one of your configured trap destination IP addresses. These are the IP addresses of the SNMP managers. You must first configure a trap destination IP address in the **SNMP Setting** screen. Use the rest of the screen to select which traps the Switch sends to that SNMP manager.
Type	Select the categories of SNMP traps that the Switch is to send to the SNMP manager.
Options	Select the individual SNMP traps that the Switch is to send to the SNMP station. See Section 30.3.3 on page 249 for individual trap descriptions. The traps are grouped by category. Selecting a category automatically selects all of the category's traps. Clear the check boxes for individual traps that you do not want the Switch to send to the SNMP station. Clearing a category's check box automatically clears all of the category's trap check boxes (the Switch only sends traps from selected categories).
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

30.3.6 Setting Up Login Accounts

Up to five people (one administrator and four non-administrators) may access the Switch via web configurator at any one time.

- An administrator is someone who can both view and configure Switch changes. The username for the Administrator is always **admin**. The default administrator password is **1234**.

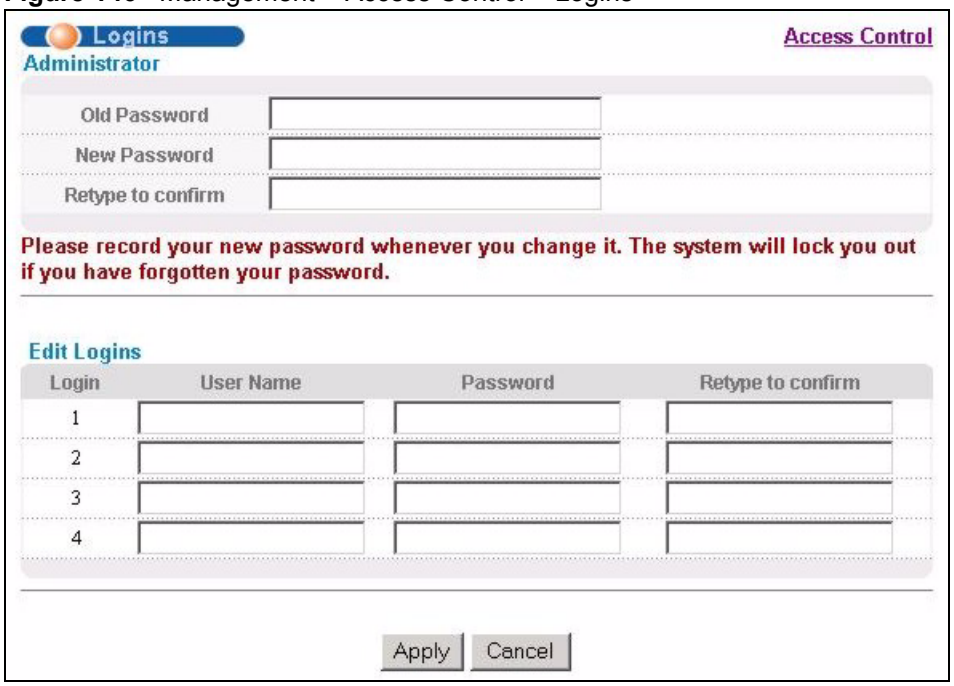


It is highly recommended that you change the default administrator password (**1234**).

- A non-administrator (username is something other than **admin**) is someone who can view but not configure Switch settings.

Click **Management > Access Control > Logins** to view the screen as shown.

Figure 146 Management > Access Control > Logins



The following table describes the labels in this screen.

Table 106 Management > Access Control > Logins

LABEL	DESCRIPTION
Administrator This is the default administrator account with the “admin” user name. You cannot change the default administrator user name. Only the administrator has read/write access.	
Old Password	Type the existing system password (**1234** is the default password when shipped).
New Password	Enter your new system password.
Retype to confirm	Retype your new system password for confirmation
Edit Logins You may configure passwords for up to four users. These users have read-only access. You can give users higher privileges via the CLI. For more information on assigning privileges see the CLI Reference Guide.	
User Name	Set a user name (up to 32 ASCII characters long).
Password	Enter your new system password.
Retype to confirm	Retype your new system password for confirmation
Apply	Click **Apply** to save your changes to the Switch’s run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

30.4 SSH Overview

Unlike Telnet or FTP, which transmit data in clear text, SSH (Secure Shell) is a secure communication protocol that combines authentication and data encryption to provide secure encrypted communication between two hosts over an unsecured network.

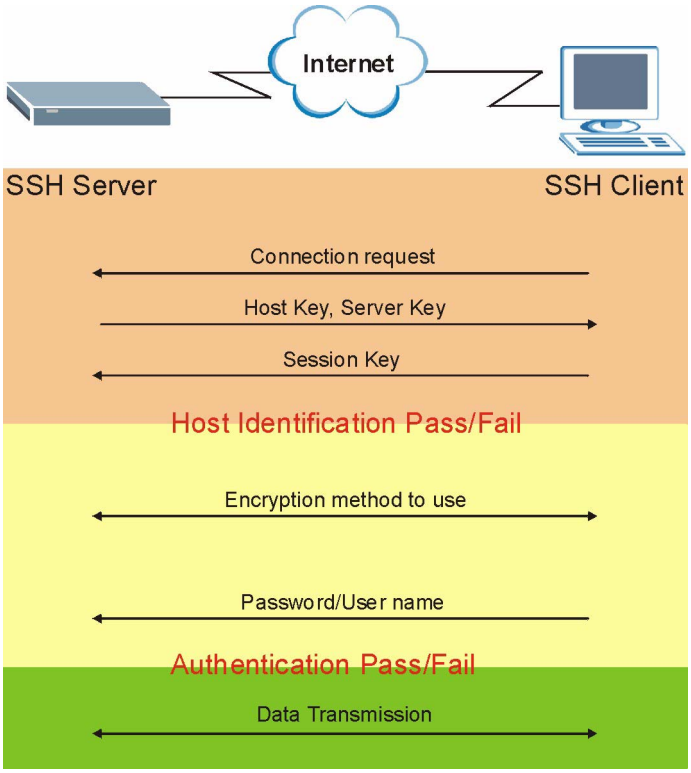
Figure 147 SSH Communication Example



30.5 How SSH works

The following table summarizes how a secure connection is established between two remote hosts.

Figure 148 How SSH Works



1 Host Identification

The SSH client sends a connection request to the SSH server. The server identifies itself with a host key. The client encrypts a randomly generated session key with the host key and server key and sends the result back to the server.

The client automatically saves any new server public keys. In subsequent connections, the server public key is checked against the saved version on the client computer.

2 Encryption Method
Once the identification is verified, both the client and server must agree on the type of encryption method to use.
3 Authentication and Data Transmission
After the identification is verified and data encryption activated, a secure tunnel is established between the client and the server. The client then sends its authentication information (user name and password) to the server to log in to the server.

30.6 SSH Implementation on the Switch

Your Switch supports SSH version 2 using RSA authentication and three encryption methods (DES, 3DES and Blowfish). The SSH server is implemented on the Switch for remote management and file transfer on port 22. Only one SSH connection is allowed at a time.

30.6.1 Requirements for Using SSH

You must install an SSH client program on a client computer (Windows or Linux operating system) that is used to connect to the Switch over SSH.

30.7 Introduction to HTTPS

HTTPS (HyperText Transfer Protocol over Secure Socket Layer, or HTTP over SSL) is a web protocol that encrypts and decrypts web pages. Secure Socket Layer (SSL) is an application-level protocol that enables secure transactions of data by ensuring confidentiality (an unauthorized party cannot read the transferred data), authentication (one party can identify the other party) and data integrity (you know if data has been changed).

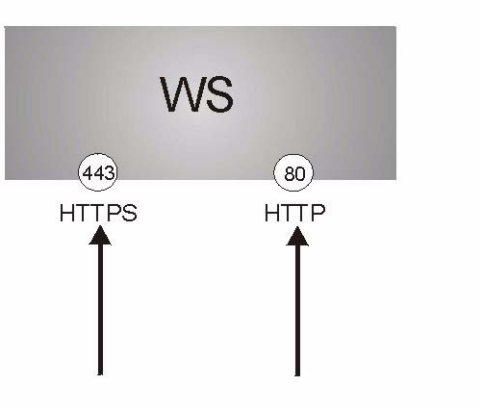
It relies upon certificates, public keys, and private keys.

HTTPS on the Switch is used so that you may securely access the Switch using the web configurator. The SSL protocol specifies that the SSL server (the Switch) must always authenticate itself to the SSL client (the computer which requests the HTTPS connection with the Switch), whereas the SSL client only should authenticate itself when the SSL server requires it to do so. Authenticating client certificates is optional and if selected means the SSL-client must send the Switch a certificate. You must apply for a certificate for the browser from a CA that is a trusted CA on the Switch.

Please refer to the following figure.

1 HTTPS connection requests from an SSL-aware web browser go to port 443 (by default) on the Switch's WS (web server).
2 HTTP connection requests from a web browser go to port 80 (by default) on the Switch's WS (web server).

Figure 149 HTTPS Implementation



If you disable **HTTP** in the **Service Access Control** screen, then the Switch blocks all HTTP connection attempts.

30.8 HTTPS Example

If you haven't changed the default HTTPS port on the Switch, then in your browser enter "https://Switch IP Address/" as the web site address where "Switch IP Address" is the IP address or domain name of the Switch you wish to access.

30.8.1 Internet Explorer Warning Messages

When you attempt to access the Switch HTTPS server, a Windows dialog box pops up asking if you trust the server certificate. Click **View Certificate** if you want to verify that the certificate is from the Switch.

You see the following **Security Alert** screen in Internet Explorer. Select **Yes** to proceed to the web configurator login screen; if you select **No**, then web configurator access is blocked.

Figure 150 Security Alert Dialog Box (Internet Explorer)


Security Alert
Information you exchange with this site cannot be viewed or changed by others. However, there is a problem with the site's security certificate.
The security certificate was issued by a company you have not chosen to trust. View the certificate to determine whether you want to trust the certifying authority.
The security certificate date is valid.
The name on the security certificate is invalid or does not match the name of the site
Do you want to proceed?
Yes
No
View Certificate

30.8.2 Netscape Navigator Warning Messages

When you attempt to access the Switch HTTPS server, a **Website Certified by an Unknown Authority** screen pops up asking if you trust the server certificate. Click **Examine Certificate** if you want to verify that the certificate is from the Switch.

If **Accept this certificate temporarily for this session** is selected, then click **OK** to continue in Netscape.

Select **Accept this certificate permanently** to import the Switch's certificate into the SSL client.

Figure 151 Security Certificate 1 (Netscape)

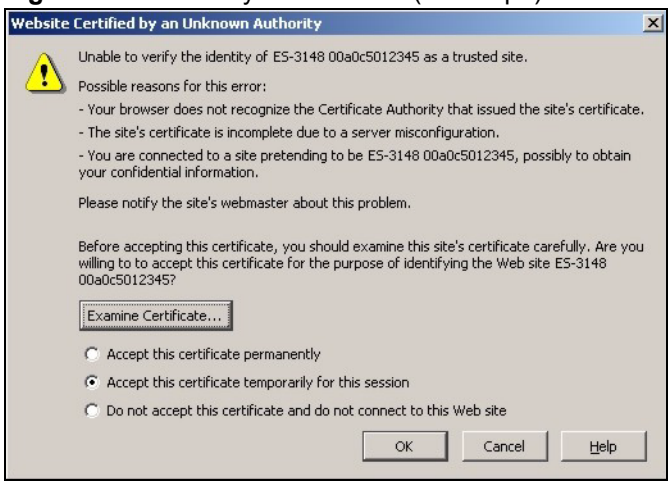

Website Certified by an Unknown Authority
Unable to verify the identity of ES-3148 00a0c5012345 as a trusted site.
Possible reasons for this error:
- Your browser does not recognize the Certificate Authority that issued the site's certificate.
- The site's certificate is incomplete due to a server misconfiguration.
- You are connected to a site pretending to be ES-3148 00a0c5012345, possibly to obtain your confidential information.
Please notify the site's webmaster about this problem.
Before accepting this certificate, you should examine this site's certificate carefully. Are you willing to to accept this certificate for the purpose of identifying the Web site ES-3148 00a0c5012345?
Examine Certificate...
Accept this certificate permanently
Accept this certificate temporarily for this session
Do not accept this certificate and do not connect to this Web site
OK
Cancel
Help

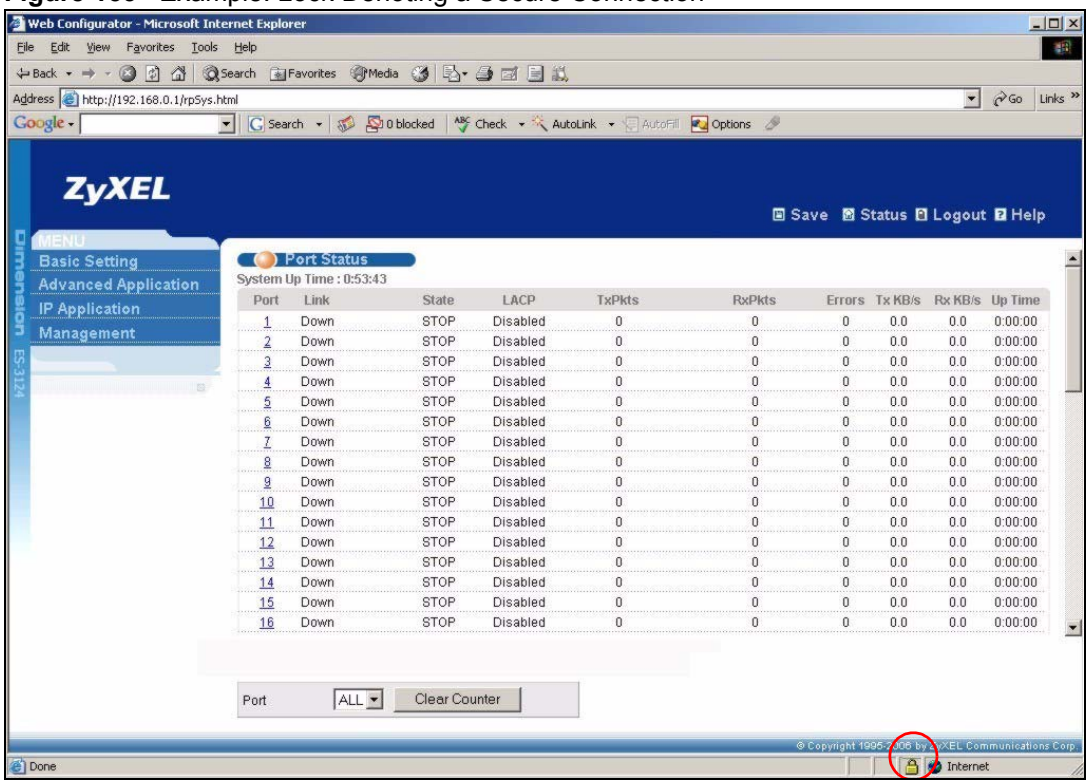
Figure 152 Security Certificate 2 (Netscape)


Security Error: Domain Name Mismatch
You have attempted to establish a connection with "192.168.1.1". However, the security certificate presented belongs to "ES-3148 00a0c5012345". It is possible, though unlikely, that someone may be trying to intercept your communication with this web site.
If you suspect the certificate shown does not belong to "192.168.1.1", please cancel the connection and notify the site administrator.
View Certificate
OK
Cancel
Help

30.8.3 The Main Screen

After you accept the certificate and enter the login username and password, the Switch main screen appears. The lock displayed in the bottom right of the browser status bar denotes a secure connection.

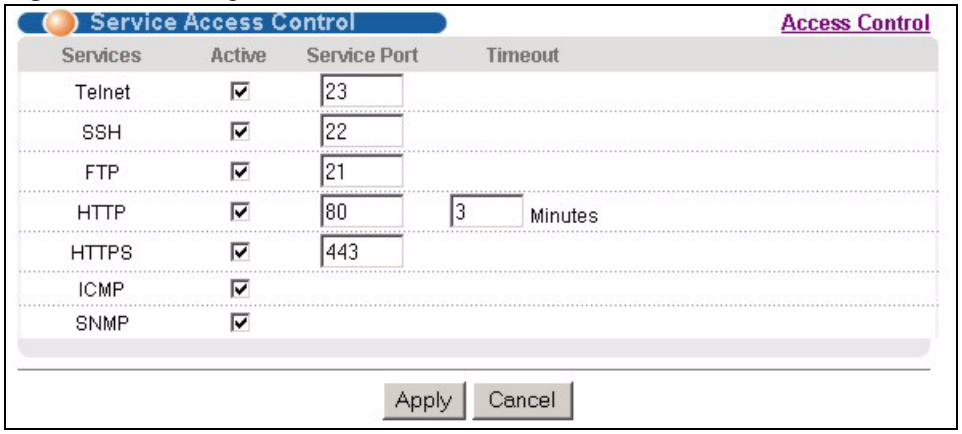
Figure 153 Example: Lock Denoting a Secure Connection



30.9 Service Port Access Control

Service Access Control allows you to decide what services you may use to access the Switch. You may also change the default service port and configure "trusted computer(s)" for each service in the **Remote Management** screen (discussed later). Click **Access Control** to go back to the main **Access Control** screen.

Figure 154 Management > Access Control > Service Access Control



The following table describes the fields in this screen.

Table 107 Management > Access Control > Service Access Control

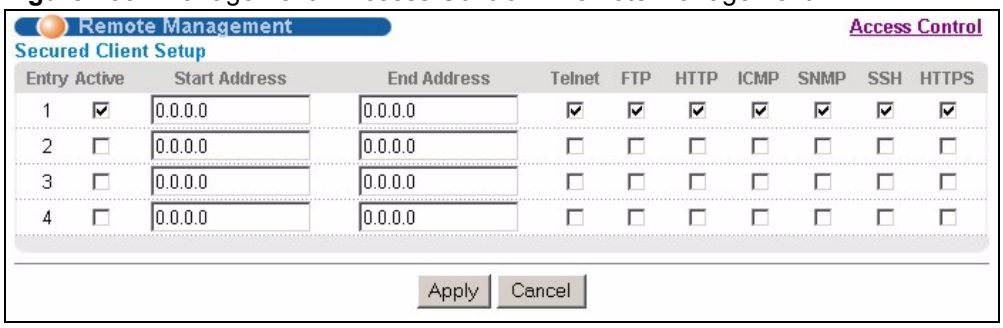
LABEL	DESCRIPTION
Services	Services you may use to access the Switch are listed here.
Active	Select this option for the corresponding services that you want to allow to access the Switch.
Service Port	For Telnet, SSH, FTP, HTTP or HTTPS services, you may change the default service port by typing the new port number in the **Server Port** field. If you change the default port number then you will have to let people (who wish to use the service) know the new port number for that service.
Timeout	Type how many minutes a management session (via the web configurator) can be left idle before the session times out. After it times out you have to log in with your password again. Very long idle timeouts may have security risks.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

30.10 Remote Management

From the **Access Control** screen, display the **Remote Management** screen as shown next.

You can specify a group of one or more "trusted computers" from which an administrator may use a service to manage the Switch. Click **Access Control** to return to the **Access Control** screen.

Figure 155 Management > Access Control > Remote Management



The following table describes the labels in this screen.

Table 108 Management > Access Control > Remote Management

LABEL	DESCRIPTION
Entry	This is the client set index number. A "client set" is a group of one or more "trusted computers" from which an administrator may use a service to manage the Switch.
Active	Select this check box to activate this secured client set. Clear the check box if you wish to temporarily disable the set without deleting it.
Start Address End Address	Configure the IP address range of trusted computers from which you can manage this Switch. The Switch checks if the client IP address of a computer requesting a service or protocol matches the range set here. The Switch immediately disconnects the session if it does not match.

Table 108 Management > Access Control > Remote Management (continued)

LABEL	DESCRIPTION
Telnet/FTP/ HTTP/ICMP/ SNMP/SSH/ HTTPS	Select services that may be used for managing the Switch from the specified trusted computers.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

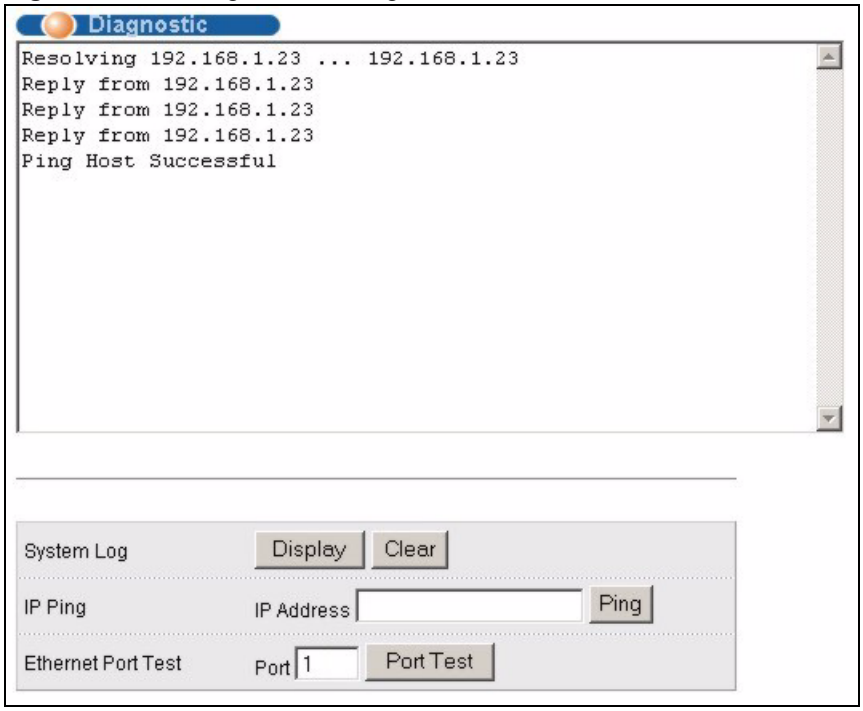
31 Diagnostic

This chapter explains the **Diagnostic** screen.

31.1 Diagnostic

Click **Management** > **Diagnostic** in the navigation panel to open this screen. Use this screen to check system logs, ping IP addresses or perform port tests.

Figure 156 Management > Diagnostic



The following table describes the labels in this screen.

Table 109 Management > Diagnostic

LABEL	DESCRIPTION
System Log	Click **Display** to display a log of events in the multi-line text box. Click **Clear** to empty the text box and reset the syslog entry.
IP Ping	Type the IP address of a device that you want to ping in order to test a connection. Click **Ping** to have the Switch ping the IP address (in the field to the left).
Ethernet Port Test	Enter a port number and click **Port Test** to perform an internal loopback test.

32 Syslog

This chapter explains the syslog screens.

32.1 Syslog Overview

The syslog protocol allows devices to send event notification messages across an IP network to syslog servers that collect the event messages. A syslog-enabled device can generate a syslog message and send it to a syslog server.

Syslog is defined in RFC 3164. The RFC defines the packet format, content and system log related information of syslog messages. Each syslog message has a facility and severity level. The syslog facility identifies a file in the syslog server. Refer to the documentation of your syslog program for details. The following table describes the syslog severity levels.

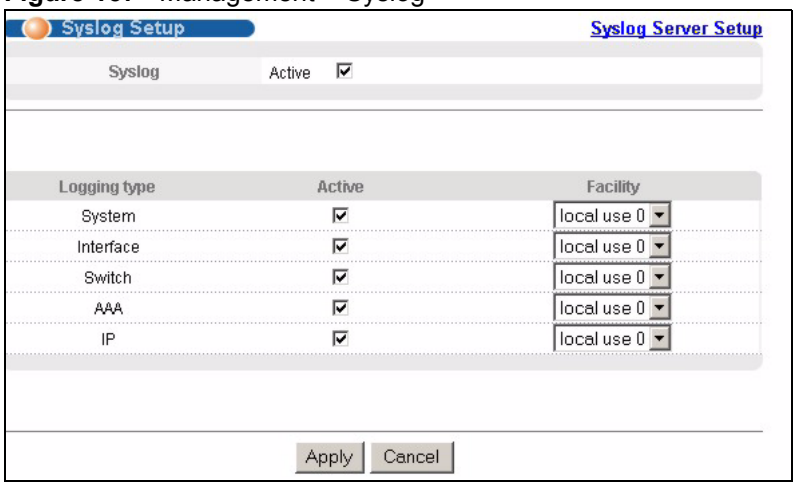
Table 110 Syslog Severity Levels

CODE	SEVERITY
0	Emergency: The system is unusable.
1	Alert: Action must be taken immediately.
2	Critical: The system condition is critical.
3	Error: There is an error condition on the system.
4	Warning: There is a warning condition on the system.
5	Notice: There is a normal but significant condition on the system.
6	Informational: The syslog contains an informational message.
7	Debug: The message is intended for debug-level purposes.

32.2 Syslog Setup

Click **Management** > **Syslog** in the navigation panel to display this screen. The syslog feature sends logs to an external syslog server. Use this screen to configure the device's system logging settings.

Figure 157 Management > Syslog



The following table describes the labels in this screen.

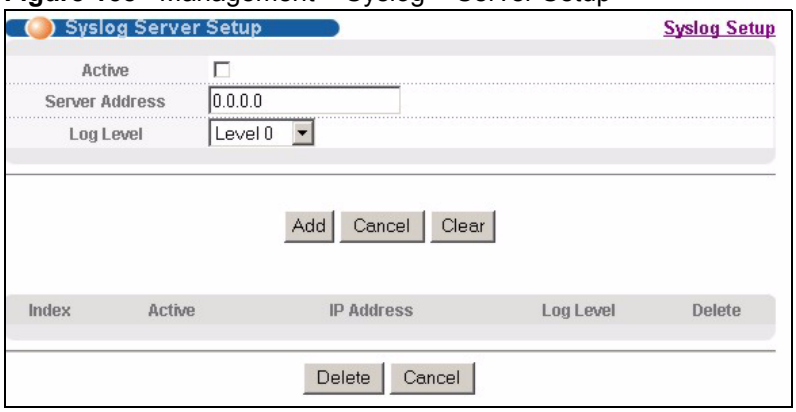
Table 111 Management > Syslog

LABEL	DESCRIPTION
Syslog	Select **Active** to turn on syslog (system logging) and then configure the syslog setting
Logging Type	This column displays the names of the categories of logs that the device can generate.
Active	Select this option to set the device to generate logs for the corresponding category.
Facility	The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog program for more details.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

32.3 Syslog Server Setup

Click **Management** > **Syslog** > **Syslog Server Setup** to open the following screen. Use this screen to configure a list of external syslog servers.

Figure 158 Management > Syslog > Server Setup



The following table describes the labels in this screen.

Table 112 Management > Syslog > Server Setup

LABEL	DESCRIPTION
Active	Select this check box to have the device send logs to this syslog server. Clear the check box if you want to create a syslog server entry but not have the device send logs to it (you can edit the entry later).
Server Address	Enter the IP address of the syslog server.
Log Level	Select the severity level(s) of the logs that you want the device to send to this syslog server. The lower the number, the more critical the logs are.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clear	Click **Clear** to return the fields to the factory defaults.
Index	This is the index number of a syslog server entry. Click this number to edit the entry.
Active	This field displays **Yes** if the device is to send logs to the syslog server. **No** displays if the device is not to send logs to the syslog server.
IP Address	This field displays the IP address of the syslog server.
Log Level	This field displays the severity level of the logs that the device is to send to this syslog server.
Delete	Select an entry's **Delete** check box and click **Delete** to remove the entry.
Cancel	Click **Cancel** to begin configuring this screen afresh.

33

Cluster Management

This chapter introduces cluster management.

33.1 Clustering Management Status Overview

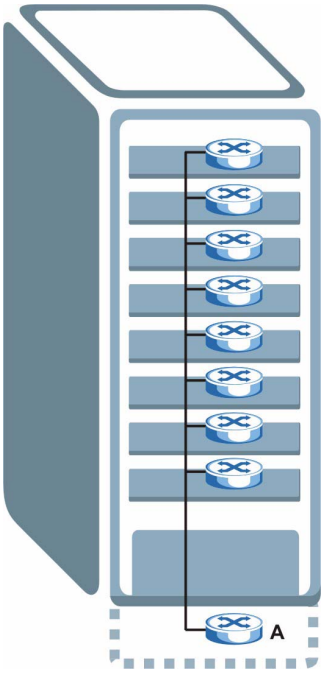
Cluster Management allows you to manage switches through one switch, called the cluster manager. The switches must be directly connected and be in the same VLAN group so as to be able to communicate with one another.

Table 113 ZyXEL Clustering Management Specifications

Maximum number of cluster members	24
Cluster Member Models	Must be compatible with ZyXEL cluster management implementation.
Cluster Manager	The Switch through which you manage the cluster member switches.
Cluster Members	The switches being managed by the cluster manager switch.

In the following example, switch **A** in the basement is the cluster manager and the other switches on the upper floors of the building are cluster members.

Figure 159 Clustering Application Example

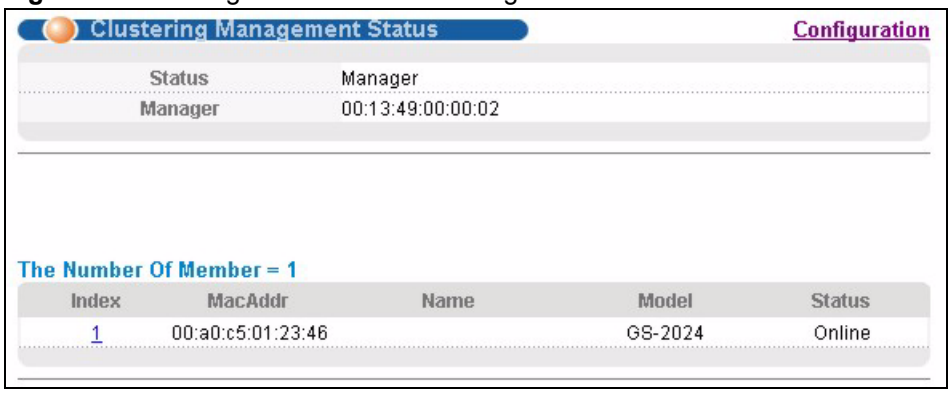


33.2 Cluster Management Status

Click **Management** > **Cluster Management** in the navigation panel to display the following screen.

A cluster can only have one manager.

Figure 160 Management > Cluster Management



The following table describes the labels in this screen.

Table 114 Management > Cluster Management

LABEL	DESCRIPTION
Status	This field displays the role of this Switch within the cluster. **Manager** **Member** (you see this if you access this screen in the cluster member switch directly and not via the cluster manager) **None** (neither a manager nor a member of a cluster)
Manager	This field displays the cluster manager switch's hardware MAC address.
The Number of Member	This field displays the number of switches that make up this cluster. The following fields describe the cluster member switches.
Index	You can manage cluster member switches via the cluster manager switch. Each number in the **Index** column is a hyperlink leading to the cluster member switch's web configurator (see Figure 161 on page 275).
MacAddr	This is the cluster member switch's hardware MAC address.
Name	This is the cluster member switch's **System Name**.
Model	This field displays the model name.
Status	This field displays: **Online** (the cluster member switch is accessible) **Error** (for example the cluster member switch password was changed or the switch was set as the manager and so left the member list, etc.) **Offline** (the switch is disconnected - **Offline** shows approximately 1.5 minutes after the link between cluster member and manager goes down)

33.2.1 Cluster Member Switch Management

Go to the **Clustering Management Status** screen of the cluster manager switch and then select an **Index** hyperlink from the list of members to go to that cluster member switch's web configurator home page. This cluster member web configurator home page and the home page that you'd see if you accessed it directly are different.

Figure 161 Cluster Management: Cluster Member Web Configurator Screen



33.2.1.1 Uploading Firmware to a Cluster Member Switch

You can use FTP to upload firmware to a cluster member switch through the cluster manager switch as shown in the following example.

Figure 162 Example: Uploading Firmware to a Cluster Member Switch

```
C:\>ftp 192.168.1.1
Connected to 192.168.1.1.
220 Switch FTP version 1.0 ready at Thu Jan  1 00:58:46 1970
User (192.168.0.1:(none)): admin
331 Enter PASS command
Password:
230 Logged in
ftp> ls
200 Port command okay
150 Opening data connection for LIST
--w--w--w-   1 owner    group         3042210 Jul 01 12:00 ras
-rw-rw-rw-   1 owner    group          393216 Jul 01 12:00 config
--w--w--w-   1 owner    group               0 Jul 01 12:00 fw-00-a0-c5-01-23-46
-rw-rw-rw-   1 owner    group               0 Jul 01 12:00 config-00-a0-c5-01-23-46
226 File sent OK
ftp: 297 bytes received in 0.00Seconds 297000.00Kbytes/sec.
ftp> bin
200 Type I OK
ftp> put 370lt0.bin fw-00-a0-c5-01-23-46
200 Port command okay
150 Opening data connection for STOR fw-00-a0-c5-01-23-46
226 File received OK
ftp: 262144 bytes sent in 0.63Seconds 415.44Kbytes/sec.
ftp>
```

The following table explains some of the FTP parameters.

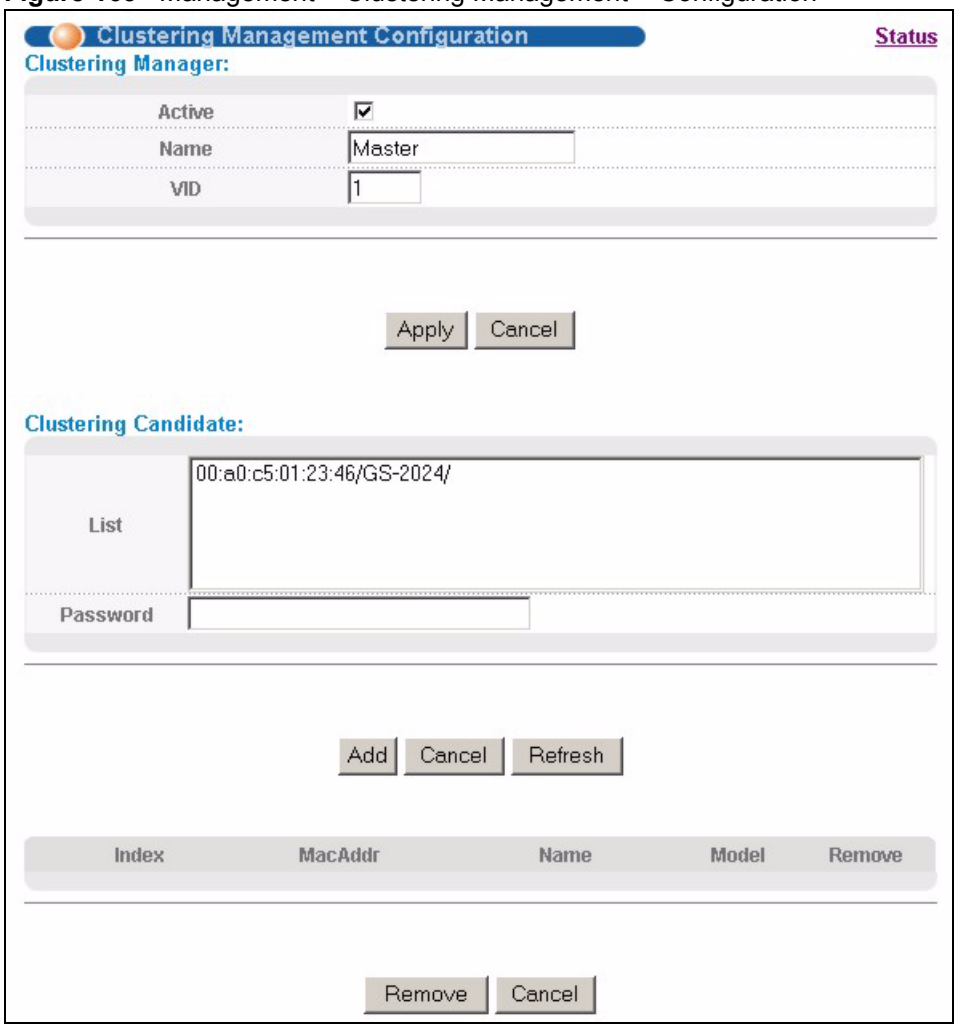
Table 115 FTP Upload to Cluster Member Example

FTP PARAMETER	DESCRIPTION
`User`	Enter “admin”.
`Password`	The web configurator password default is 1234.
`ls`	Enter this command to list the name of cluster member switch’s firmware and configuration file.
`360lt0.bin`	This is the name of the firmware file you want to upload to the cluster member switch.
`fw-00-a0-c5-01-23-46`	This is the cluster member switch’s firmware name as seen in the cluster manager switch.
`config-00-a0-c5-01-23-46`	This is the cluster member switch’s configuration file name as seen in the cluster manager switch.

33.3 Clustering Management Configuration

Use this screen to configure clustering management. Click **Configuration** from the **Cluster Management** screen to display the next screen.

Figure 163 Management > Clustering Management > Configuration



The following table describes the labels in this screen.

Table 116 Management > Clustering Management > Configuration

LABEL	DESCRIPTION
Clustering Manager	
Active	Select **Active** to have this Switch become the cluster manager switch. A cluster can only have one manager. Other (directly connected) switches that are set to be cluster managers will not be visible in the **Clustering Candidates** list. If a switch that was previously a cluster member is later set to become a cluster manager, then its **Status** is displayed as **Error** in the **Cluster Management Status** screen and a warning icon (⚠) appears in the member summary list below.
Name	Type a name to identify the **Clustering Manager.** You may use up to 32 printable characters (spaces are allowed).
VID	This is the VLAN ID and is only applicable if the Switch is set to **802.1Q** VLAN. All switches must be directly connected and in the same VLAN group to belong to the same cluster. Switches that are not in the same VLAN group are not visible in the **Clustering Candidates** list. This field is ignored if the **Clustering Manager** is using **Port-based** VLAN.

Table 116 Management > Clustering Management > Configuration (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Clustering Candidate	The following fields relate to the switches that are potential cluster members.
List	A list of suitable candidates found by auto-discovery is shown here. The switches must be directly connected. Directly connected switches that are set to be cluster managers will not be visible in the **Clustering Candidate** list. Switches that are not in the same management VLAN group will not be visible in the **Clustering Candidate** list.
Password	Each cluster member's password is its web configurator password. Select a member in the **Clustering Candidate** list and then enter its web configurator password. If that switch administrator changes the web configurator password afterwards, then it cannot be managed from the **Cluster Manager**. Its **Status** is displayed as **Error** in the **Cluster Management Status** screen and a warning icon (⚠) appears in the member summary list below. If multiple devices have the same password then hold [SHIFT] and click those switches to select them. Then enter their common web configurator password.
Add	Click **Add** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Refresh	Click **Refresh** to perform auto-discovery again to list potential cluster members.
The next summary table shows the information for the clustering members configured.	
Index	This is the index number of a cluster member switch.
MacAddr	This is the cluster member switch's hardware MAC address.
Name	This is the cluster member switch's **System Name**.
Model	This is the cluster member switch's model name.
Remove	Select this checkbox and then click the **Remove** button to remove a cluster member switch from the cluster.
Cancel	Click **Cancel** to begin configuring this screen afresh.

34

MAC Table

This chapter introduces the **MAC Table** screen.

34.1 MAC Table Overview

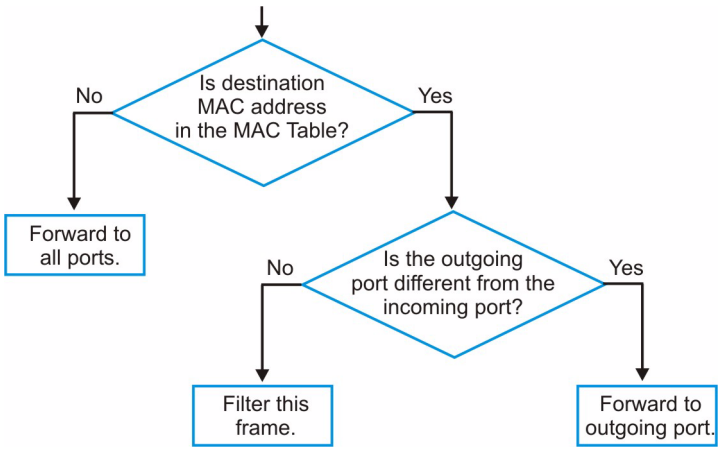
The **MAC Table** screen (a MAC table is also known as a filtering database) shows how frames are forwarded or filtered across the Switch's ports. It shows what device MAC address, belonging to what VLAN group (if any) is forwarded to which port(s) and whether the MAC address is dynamic (learned by the Switch) or static (manually entered in the **Static MAC Forwarding** screen).

The Switch uses the MAC table to determine how to forward frames. See the following figure.

1. The Switch examines a received frame and learns the port on which this source MAC address came.
2. The Switch checks to see if the frame's destination MAC address matches a source MAC address already learned in the MAC table.

- If the Switch has already learned the port for this MAC address, then it forwards the frame to that port.
- If the Switch has not already learned the port for this MAC address, then the frame is flooded to all ports. Too much port flooding leads to network congestion.
- If the Switch has already learned the port for this MAC address, but the destination port is the same as the port it came in on, then it filters the frame.

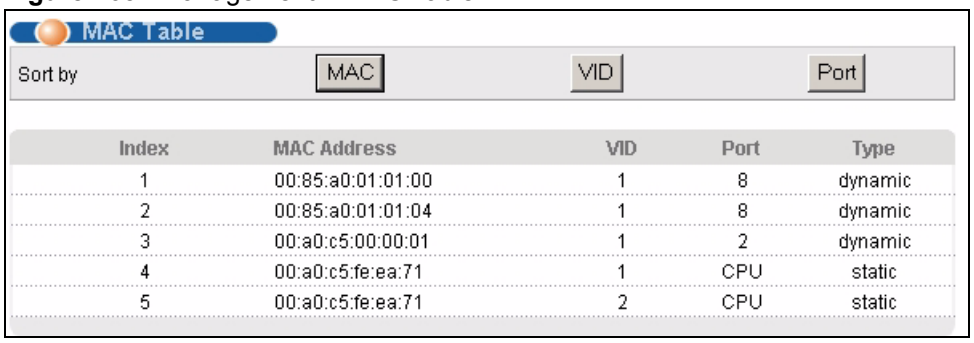
Figure 164 MAC Table Flowchart



34.2 Viewing the MAC Table

Click **Management** > **MAC Table** in the navigation panel to display the following screen.

Figure 165 Management > MAC Table



The following table describes the labels in this screen.

Table 117 Management > MAC Table

LABEL	DESCRIPTION
Sort by	Click one of the following buttons to display and arrange the data according to that button type. The information is then displayed in the summary table below.
MAC	Click this button to display and arrange the data according to MAC address.
VID	Click this button to display and arrange the data according to VLAN group.
Port	Click this button to display and arrange the data according to port number.
Index	This is the incoming frame index number.
MAC Address	This is the MAC address of the device from which this incoming frame came.
VID	This is the VLAN group to which this frame belongs.
Port	This is the port from which the above MAC address was learned.
Type	This shows whether the MAC address is **dynamic** (learned by the Switch) or **static** (manually entered in the **Static MAC Forwarding** screen).

35

ARP Table

This chapter introduces ARP Table.

35.1 ARP Table Overview

Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address, also known as a Media Access Control or MAC address, on the local area network.

An IP (version 4) address is 32 bits long. In an Ethernet LAN, MAC addresses are 48 bits long. The ARP Table maintains an association between each MAC address and its corresponding IP address.

35.1.1 How ARP Works

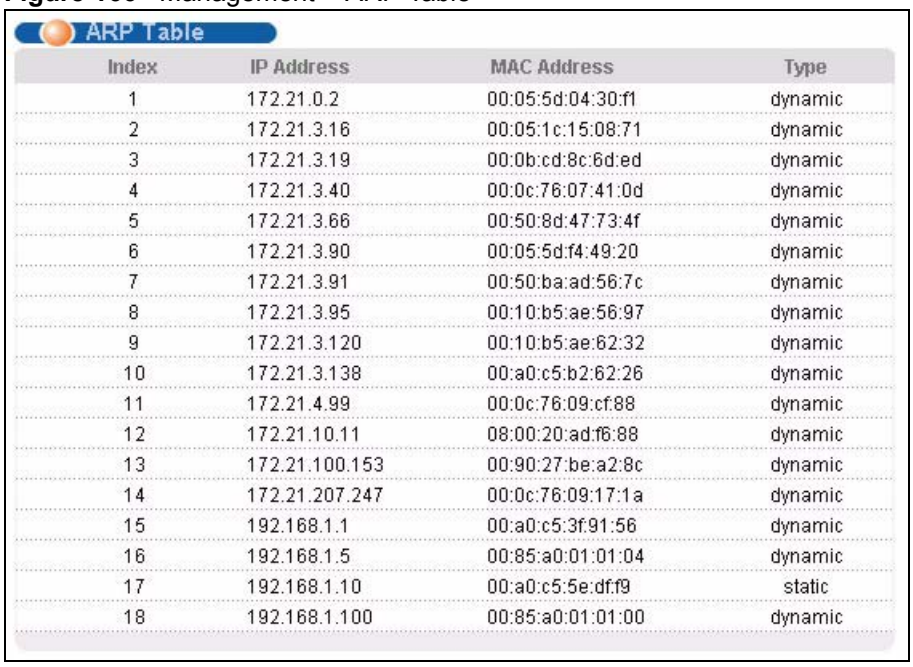
When an incoming packet destined for a host device on a local area network arrives at the Switch, the Switch's ARP program looks in the ARP Table and, if it finds the address, sends it to the device.

If no entry is found for the IP address, ARP broadcasts the request to all the devices on the LAN. The Switch fills in its own MAC and IP address in the sender address fields, and puts the known IP address of the target in the target IP address field. In addition, the Switch puts all ones in the target MAC field (FF.FF.FF.FF.FF.FF is the Ethernet broadcast address). The replying device (which is either the IP address of the device being sought or the router that knows the way) replaces the broadcast address with the target's MAC address, swaps the sender and target pairs, and unicasts the answer directly back to the requesting machine. ARP updates the ARP Table for future reference and then sends the packet to the MAC address that replied.

35.2 Viewing the ARP Table

Click **Management** > **ARP Table** in the navigation panel to open the following screen. Use the ARP table to view IP-to-MAC address mapping(s).

Figure 166 Management > ARP Table



ARP Table

Index	IP Address	MAC Address	Type
1	172.21.0.2	00:05:5d:04:30:f1	dynamic
2	172.21.3.16	00:05:1c:15:08:71	dynamic
3	172.21.3.19	00:0b:cd:8c:6d:ed	dynamic
4	172.21.3.40	00:0c:76:07:41:0d	dynamic
5	172.21.3.66	00:50:8d:47:73:4f	dynamic
6	172.21.3.90	00:05:5d:f4:49:20	dynamic
7	172.21.3.91	00:50:ba:ad:56:7c	dynamic
8	172.21.3.95	00:10:b5:ae:56:97	dynamic
9	172.21.3.120	00:10:b5:ae:62:32	dynamic
10	172.21.3.138	00:a0:c5:b2:62:26	dynamic
11	172.21.4.99	00:0c:76:09:cf:88	dynamic
12	172.21.10.11	08:00:20:ad:f6:88	dynamic
13	172.21.100.153	00:90:27:be:a2:8c	dynamic
14	172.21.207.247	00:0c:76:09:17:1a	dynamic
15	192.168.1.1	00:a0:c5:3f:91:56	dynamic
16	192.168.1.5	00:85:a0:01:01:04	dynamic
17	192.168.1.10	00:a0:c5:5e:df:f9	static
18	192.168.1.100	00:85:a0:01:01:00	dynamic

The following table describes the labels in this screen.

Table 118 Management > ARP Table

LABEL	DESCRIPTION
Index	This is the ARP Table entry number.
IP Address	This is the learned IP address of a device connected to a Switch port with corresponding MAC address below.
MAC Address	This is the MAC address of the device with corresponding IP address above.
Type	This shows whether the MAC address is dynamic (learned by the Switch) or static (manually entered in the **Static MAC Forwarding** screen).

36

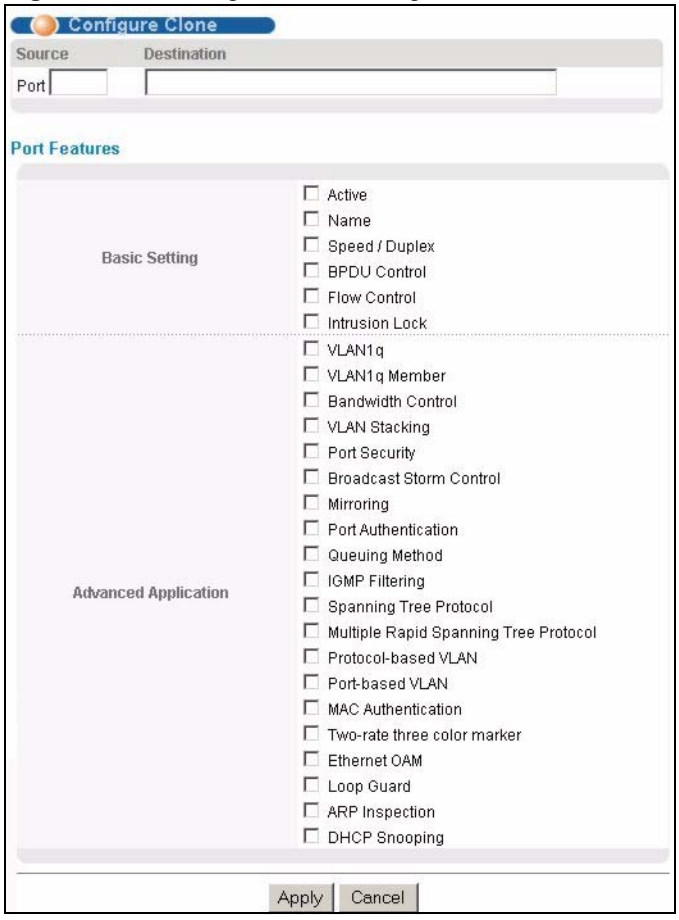
Configure Clone

This chapter shows you how you can copy the settings of one port onto other ports.

36.1 Configure Clone

Cloning allows you to copy the basic and advanced settings from a source port to a destination port or ports. Click **Management** > **Configure Clone** to open the following screen.

Figure 167 Management > Configure Clone



The following table describes the labels in this screen.

Table 119 Management > Configure Clone

LABEL	DESCRIPTION
Source/ Destination Port	Enter the source port under the **Source** label. This port's attributes are copied. Enter the destination port or ports under the **Destination** label. These are the ports which are going to have the same attributes as the source port. You can enter individual ports separated by a comma or a range of ports by using a dash. Example: • **2, 4, 6** indicates that ports 2, 4 and 6 are the destination ports. • **2-6** indicates that ports 2 through 6 are the destination ports.
Basic Setting	Select which port settings (you configured in the **Basic Setting** menus) should be copied to the destination port(s).
Advanced Application	Select which port settings (you configured in the **Advanced Application** menus) should be copied to the destination ports.
Apply	Click **Apply** to save your changes to the Switch's run-time memory. The Switch loses these changes if it is turned off or loses power, so use the **Save** link on the top navigation panel to save your changes to the non-volatile memory when you are done configuring.
Cancel	Click **Cancel** to begin configuring this screen afresh.

PART IV
Troubleshooting and Specifications

Troubleshooting (287)
Product Specifications (291)

37

Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories.

- Power, Hardware Connections, and LEDs
- Switch Access and Login

37.1 Power, Hardware Connections, and LEDs

The Switch does not turn on. None of the LEDs turn on.

1. Make sure the Switch is turned on (DC models).
2. Make sure you are using the power adaptor or cord included with the Switch.
3. Make sure the power adaptor or cord is connected to the Switch and plugged in to an appropriate power source. Make sure the power source is turned on.
4. Turn the Switch off and on (DC models).
5. Disconnect and re-connect the power adaptor or cord to the Switch (AC models).
6. If the problem continues, contact the vendor.

The **ALARM/ALM** LED is on.

1. Turn the Switch off and on. (DC models)
2. Disconnect and re-connect the power adaptor to the Switch. (AC models)
3. If the problem continues, contact the vendor.

One of the LEDs does not behave as expected.

1. Make sure you understand the normal behavior of the LED. See Section 3.3 on page 50.
2. Check the hardware connections. See Chapter 2 on page 41.

3 Inspect your cables for damage. Contact the vendor to replace any damaged cables.
4 Turn the Switch off and on (DC models).
5 Disconnect and re-connect the power adaptor to the Switch (AC models).
6 If the problem continues, contact the vendor.

37.2 Switch Access and Login

I forgot the IP address for the Switch.

1 The default out-of-band management IP address is **192.168.0.1**. The default in-band management IP address is **192.168.1.1**.
2 Use the console port to log in to the Switch.
3 Use the management port to log in to the Switch. Use the out-of-band management IP address.
4 If this does not work, you have to reset the Switch to its factory defaults. See Section 4.6 on page 62.

I forgot the user name or password.

1 The default user name is **admin**, and the default password is **1234**. These fields are case-sensitive, so make sure [Caps Lock] is not on.
2 If this does not work, you have to reset the Switch to its factory defaults. See Section 4.6 on page 62.

I cannot see or access the **Login** screen in the web configurator.

1 Make sure you are using the correct IP address.
   - The default out-of-band management IP address is 192.168.0.1.
   - The default in-band management IP address is 192.168.1.1.
   - If you changed the IP address (Section 7.6 on page 82), use the new IP address.
   - If you changed the IP address and have forgotten it, see the troubleshooting suggestions for I forgot the IP address for the Switch.
2 Check the hardware connections, and make sure the LEDs are behaving as expected. See Section 3.3 on page 50.
3 Make sure your Internet browser does not block pop-up windows and has JavaScripts and Java enabled. See Appendix B on page 323.

4 Make sure your computer is in the same subnet as the Switch. (If you know that there are routers between your computer and the Switch, skip this step.)
5 Try to access the Switch using another service, such as Telnet. If you can access the Switch, check the remote management and secure client settings to find out why the Switch does not respond to HTTP.
6 Reset the Switch to its factory defaults, and try to access the Switch with the default IP address. See Section 4.6 on page 62.
7 If the problem continues, contact the vendor.

I can see the **Login** screen, but I cannot log in to the Switch.

1 Make sure you have entered the user name and password correctly. The default user name is **admin**, and the default password is **1234**. These fields are case-sensitive, so make sure [Caps Lock] is not on.
2 You cannot log in to the web configurator while someone is using the Telnet or the console port to access the Switch. Log out of the Switch in the other session, or ask the person who is logged in to log out.
3 Turn the Switch off and on (DC models).
4 Disconnect and re-connect the power adaptor or cord to the Switch (AC models).
5 If this does not work, you have to reset the Switch to its factory defaults. See Section 4.6 on page 62.

I cannot Telnet to the Switch.

See the troubleshooting suggestions for I cannot see or access the Login screen in the web configurator. Ignore the suggestions about your browser. In addition, consider the following suggestions before you reset the Switch to its factory defaults.

1 You may have exceeded the maximum number of concurrent Telnet sessions. Close other Telnet sessions, or try connecting again later.
2 Try to access the Switch using another service, such as HTTP. If you can access the Switch, check the remote management and secure client settings to find out why the Switch does not respond to Telnet.

I cannot use FTP to upload / download the configuration file. / I cannot use FTP to upload new firmware.

See the troubleshooting suggestions for I cannot see or access the Login screen in the web configurator. Ignore the suggestions about your browser. In addition, consider the following suggestions before you reset the Switch to its factory defaults.

1. You may have exceeded the maximum number of concurrent FTP sessions. Close other FTP sessions, or try connecting again later.
2. Try to access the Switch using another service, such as HTTP. If you can access the Switch, check the remote management and secure client settings to find out why the Switch does not respond to FTP.

38

Product Specifications

This chapter gives details about your Switch's hardware and firmware features.

38.1 General Switch Specifications

The following tables summarize the Switch's hardware and firmware features.

Table 120 Hardware and Environmental Specifications

SPECIFICATION	DESCRIPTION
Ethernet Interface	24 10/100 Base-Tx interfaces Auto-negotiation Auto-MDI/MDIX Compliant with IEEE 802.3/3u Back pressure flow control for half duplex Flow control for full duplex (IEEE 802.3x) IEEE 802.3af Power over Ethernet compliant (ES-3124PWR only) RJ-45 Ethernet cable connector (ES-3124, ES-3124-4F and ES-3124PWR only)
Fast Ethernet SFP Interface	24 100Base SFP slots (ES-3124F only) Compliant with IEEE 802.3/3u Back pressure flow control for half duplex Flow control for full duplex (IEEE 802.3x)
Gigabit Interface	2 Gigabit Ethernet / Mini-GBIC dual-personality interfaces. 2 Gigabit Ethernet ports (ES-3124 and ES-3124PWR only) 2 Mini-GBIC ports (ES-31234-4F and ES-3124F only)
LEDs	Per Switch: BPS, PWR, SYS, ALM Per Ethernet port: LNK/ACT, PoE (ES-3124PWR only) Per Ethernet port: LNK/ACT, FDX (ES-3124 and ES-3124-4F only) Per Fast Ethernet SFP port: LNK, ACT (ES-3124F only) Per Gigabit port: LNK/ACT, FDX Per Mini-GBIC slot: LNK, ACT Per management port: 10, 100
Dimension	438 mm (W) x 270 mm (D) x 44.5 mm (H) (ES-3124, ES-3124-4F and ES-3124F only) 438 mm (W) x 420 mm (D) x 44.45 mm (H) (ES-3124PWR only) Standard 19" rack mountable
Device Weight	4 Kg (ES-3124F) 4.2 Kg (ES-3124 and ES-3124-4F) 6.8 Kg (ES-3124PWR)

Table 120 Hardware and Environmental Specifications (continued)

SPECIFICATION	DESCRIPTION
Temperature	Operating: 0º C ~ 45º C Storage: -10º C ~ 70º C
Humidity	10 ~ 90% (non-condensing)
Power Supply	Overload protection AC version ES-3124: 100 ~ 240 V, 60 W, 1.5 A max. ES-3124-4F: 100 ~ 240 V, 60 W, 1.5 A max. ES-3124F: 100~ 240 V, 58 W, 1.5 A max. ES-3124PWR: 100 ~ 240 V, 600 W, 10 A max. DC version: There is no tolerance for the DC input voltage. Power wire 18 AWG or larger. ES-3124: -48V~ -60 V, 48 W max., 1.5 A max. ES-3124-4F: -48V~ -60 V, 48 W max., 1.5 A max. ES-3124F: -48~ -60 V , 48 W, 1.5 A max.
Safety	ANS/UL 60950-1 CSA 60950-1 EN 60950-1 IEC 60950-1
EMC	FCC Part 15 (Class A) CE EMC (Class A)

Table 121 Feature Specifications

FEATURE		DESCRIPTION
Layer 2	Bridging	16K MAC addresses Static MAC address filtering (port lock) Broadcast storm control Limited maximum number of MAC addresses per port
	Switching	Switching fabric: 13.6Gbps, non-blocking Max. Frame size: 1522 bytes Forwarding frame: IEEE 802.3, IEEE 802.1q, Ethernet II, PPPoE Prevent the forwarding of corrupted packets
	STP	IEEE 802.1D Spanning Tree Protocol IEEE 802.1w Rapid Spanning Tree Protocol IEEE 802.1s Multiple Spanning Tree Protocol Up to 6 STP configurations
	QoS	IEEE 802.1p Eight priority queues Supports RFC 2475 DiffServ, DSCP to IEEE 802.1p priority mapping
	VLAN	Port-based VLAN setting Tag-based (IEEE 802.1Q) VLAN Number of VLAN: 4K (1000 static VLANs) Supports GVRP Protocol based VLAN support IP subnet-based VLAN
	Port Aggregation	Supports IEEE 802.3ad; static and dynamic (LACP) port trunking Up to six groups and each group can aggregate up to eight ports
	Port mirroring	All ports support port mirroring
	Bandwidth control	Supports rate limiting at 64Kbps increment TRTCM
Layer 3	IP Capability	IPV4 support 64 IP routing domains 4K IP address table Wire speed IP forwarding
	Routing protocols	Static Routing
	IP services	DHCP relay; VLAN-based DHCP relay DiffServ
Security		IEEE 802.1x port-based authentication Static MAC Address Forward Multiple RADIUS Servers Multiple TACACS+ Servers IP Source Guard Static IP/MAC binding DHCP snooping ARP inspection MAC authentication

Table 121 Feature Specifications (continued)

FEATURE		DESCRIPTION
Management	System Control	Alarm/Status surveillance LED indication for alarm and system status Performance monitoring Line speed Four RMON groups (history, statistics, alarms, and events) Throughput monitoring CMP packet transmission Port mirroring and aggregation Spanning Tree Protocol Loopguard IGMP snooping Firmware upgrade and download through FTP/TFTP Login authorization and security levels (read only and read/write) Self diagnostics FLASH memory Daylight saving time support 802.3ah OAM
	Network Management	CLI through console port and telnet Web-based management Clustering: up to 24 switches can be managed by one IP SNMP RMON groups (history, statistics, alarms and events)
	MIB	RFC1213 MIB II RFC1493 Bridge MIB RFC1643 Ethernet MIB RFC1757 Four groups of RMON RFC2011 IP MIB· RFC2012 TCP MIB RFC2013 UDP MIB RFC2674 Bridge MIB extension (for IEEE 802.1Q)

The following list, which is not exhaustive, illustrates the standards supported in the Switch.

Table 122 Standards Supported

STANDARD	DESCRIPTION
RFC 826	Address Resolution Protocol (ARP)
RFC 867	Daytime Protocol
RFC 868	Time Protocol.
RFC 894	Ethernet II encapsulation
RFC 1112	IGMP v1
RFC 1155	SMI
RFC 1157	SNMPv1: Simple Network Management Protocol version 1
RFC 1213	SNMP MIB II
RFC 1305	Network Time Protocol (NTP version 3)
RFC 1441	SNMPv2 Simple Network Management Protocol version 2
RFC 1493	Bridge MIBs
RFC 1643	Ethernet MIBs

Table 122 Standards Supported (continued)

STANDARD	DESCRIPTION
RFC 1757	Four groups of RMON
RFC 1901	SNMPv2c Simple Network Management Protocol version 2c
RFC 2011	SNMPv2 MIB for IP
RFC 2012	SNMPv2 MIB for TCP
RFC 2013	SNMPv2 MIB for UDP
RFC 2131	DHCP (Dynamic Host Configuration Protocol)
RFC 2132	DHCP (Dynamic Host Configuration Protocol)
RFC 2138	RADIUS (Remote Authentication Dial In User Service)
RFC 2139	RADIUS Accounting
RFC 2236	Internet Group Management Protocol (IGMP), Version 2.
RFC 2475	DiffServ, DSCP to IEEE 802.1p priority mapping
RFC 2674	P-BRIDGE-MIB, Q-BRIDGE-MIB
RFC 2698	Two Rate Three Color Marker
RFC 2865	Vendor-specific Attributes for RADIUS Authentication
RFC 2866	Vendor-specific Attributes for RADIUS Accounting
RFC 2869	Vendor-specific Attributes for RADIUS Accounting
RFC 3046	DHCP (Dynamic Host Configuration Protocol) Relay Agent Information
RFC 3164	Syslog
RFC 3376	Internet Group Management Protocol (IGMP), Version 3.
RFC 3414	User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMP v3)
RFC 3580	Tunneling Protocol Vendor-specific Attributes for RADIUS Authentication
IEEE 802.1D	MAC Bridges
IEEE 802.1d	MAC-level Priority
IEEE 802.1p	MAC-level Priority
IEEE 802.1s	Multiple Spanning Tree Protocol
IEEE 802.1Q	Tagged VLAN
IEEE 802.1w	Rapid Spanning Tree Protocol
IEEE 802.1x	Port Authenticaition
IEEE 802.3/3u	Fast Ethernet
IEEE 802.3ab	Gigabit Ethernet
IEEE 802.3ad	Link Aggregation
IEEE 802.3af	Power over Ethernet
IEEE 802.3x	Flow control
IEEE 802.3z	1000BASE-X For optical fiber link 1000BASE-SX/LX.

38.2 Cable Pin Assignments

In a serial communications connection, generally a computer is DTE (Data Terminal Equipment) and a modem is DCE (Data Circuit-terminating Equipment). The Switch is DCE when you connect a computer to the console port. The Switch is DTE when you connect a modem to the dial backup port.[3]

Figure 168 Console/Dial Backup Port Pin Layout

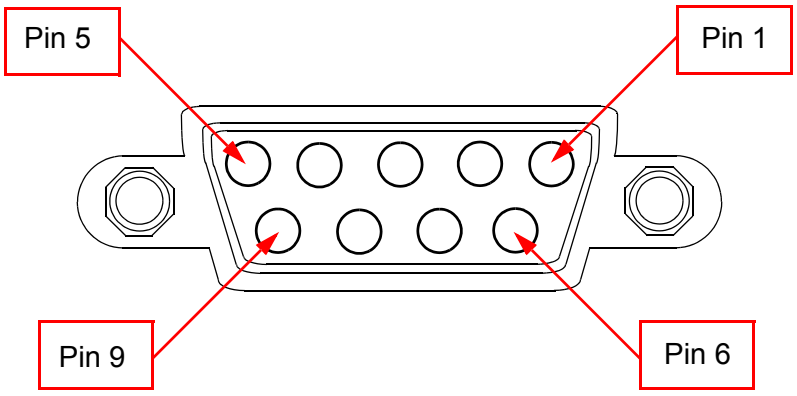


Table 123 Console/Dial Backup Port Pin Assignments

CONSOLE Port RS – 232 (Female) DB-9F	DIAL BACKUP RS – 232 (Male) DB-9M (Not on all models)
Pin 1 = NON Pin 2 = DCE-TXD Pin 3 = DCE –RXD Pin 4 = DCE –DSR Pin 5 = GND Pin 6 = DCE –DTR Pin 7 = DCE –CTS Pin 8 = DCE –RTS PIN 9 = NON	Pin 1 = NON Pin 2 = DTE-RXD Pin 3 = DTE-TXD Pin 4 = DTE-DTR Pin 5 = GND Pin 6 = DTE-DSR Pin 7 = DTE-RTS Pin 8 = DTE-CTS PIN 9 = NON.
The CON/AUX port also has these pin assignments. The CON/AUX switch changes the setting in the firmware only and does not change the CON/AUX port's pin assignments.	Switchs with a CON/AUX port also have a 9-pin adaptor for the console cable with these pin assignments on the male end.

Table 124 Ethernet Cable Pin Assignments

WAN / LAN ETHERNET CABLE PIN LAYOUT			
Straight-through		**Crossover**	
(Switch)	(Adapter)	(Switch)	(Switch)

3. Pins 2,3 and 5 are used.

Table 124 Ethernet Cable Pin Assignments

WAN / LAN ETHERNET CABLE PIN LAYOUT							
1	IRD +	1	OTD +	1	IRD +	1	IRD +
2	IRD -	2	OTD -	2	IRD -	2	IRD -
3	OTD +	3	IRD +	3	OTD +	3	OTD +
6	OTD -	6	IRD -	6	OTD -	6	OTD -

PART V
Appendices and Index



The appendices provide general information. Some details may not apply to your Switch.

Setting up Your Computer's IP Address (301)

Pop-up Windows, JavaScripts and Java Permissions (323)

IP Addresses and Subnetting (331)

Common Services (341)

Importing Certificates (345)

Legal Information (351)

Customer Support (355)

Index (361)

A

Setting up Your Computer's IP Address

All computers must have a 10M or 100M Ethernet adapter card and TCP/IP installed.

Windows 95/98/Me/NT/2000/XP/Vista, Macintosh OS 7 and later operating systems and all versions of UNIX/LINUX include the software components you need to install and use TCP/IP on your computer. Windows 3.1 requires the purchase of a third-party TCP/IP application package.

TCP/IP should already be installed on computers using Windows NT/2000/XP, Macintosh OS 7 and later operating systems.

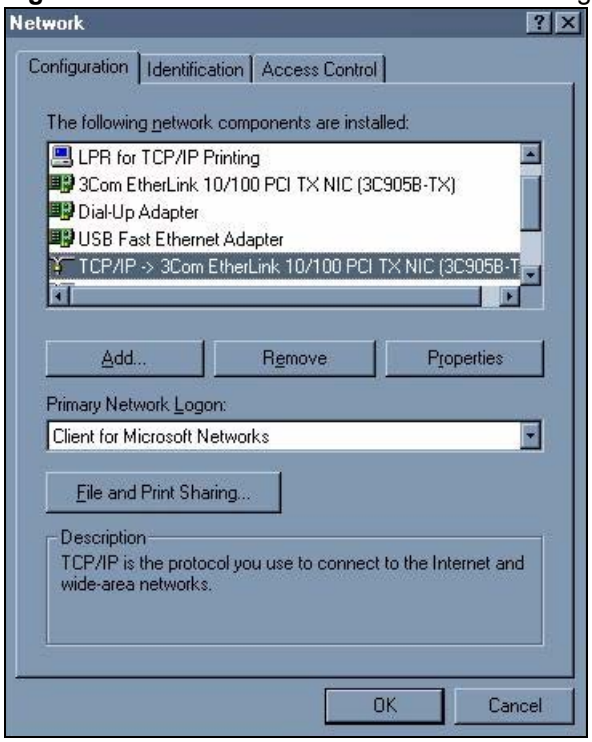
After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

If you manually assign IP information instead of using dynamic assignment, make sure that your computers have IP addresses that place them in the same subnet as the Switch's LAN port.

Windows 95/98/Me

Click **Start**, **Settings**, **Control Panel** and double-click the **Network** icon to open the **Network** window.

Figure 169 WIndows 95/98/Me: Network: Configuration



Installing Components

The **Network** window **Configuration** tab displays a list of installed components. You need a network adapter, the TCP/IP protocol and Client for Microsoft Networks.

If you need the adapter:

1. In the **Network** window, click **Add**.
2. Select **Adapter** and then click **Add**.
3. Select the manufacturer and model of your network adapter and then click **OK**.

If you need TCP/IP:

1. In the **Network** window, click **Add**.
2. Select **Protocol** and then click **Add**.
3. Select **Microsoft** from the list of **manufacturers**.
4. Select **TCP/IP** from the list of network protocols and then click **OK**.

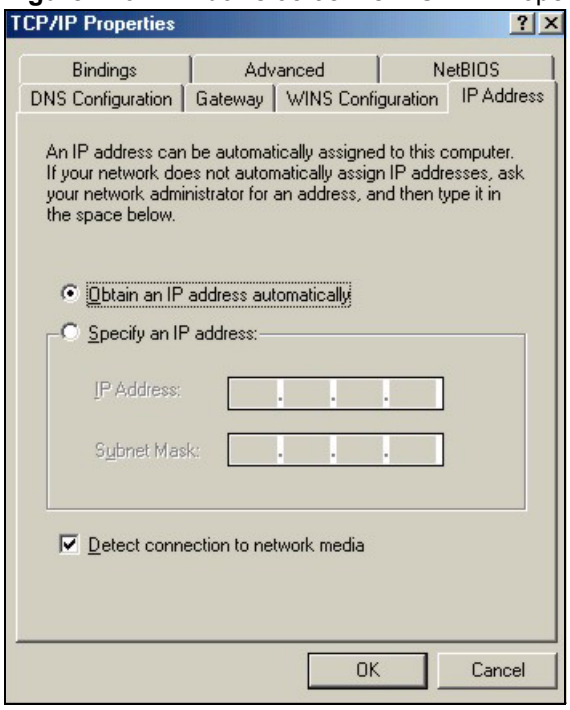
If you need Client for Microsoft Networks:

1. Click **Add**.
2. Select **Client** and then click **Add**.
3. Select **Microsoft** from the list of manufacturers.
4. Select **Client for Microsoft Networks** from the list of network clients and then click **OK**.
5. Restart your computer so the changes you made take effect.

Configuring

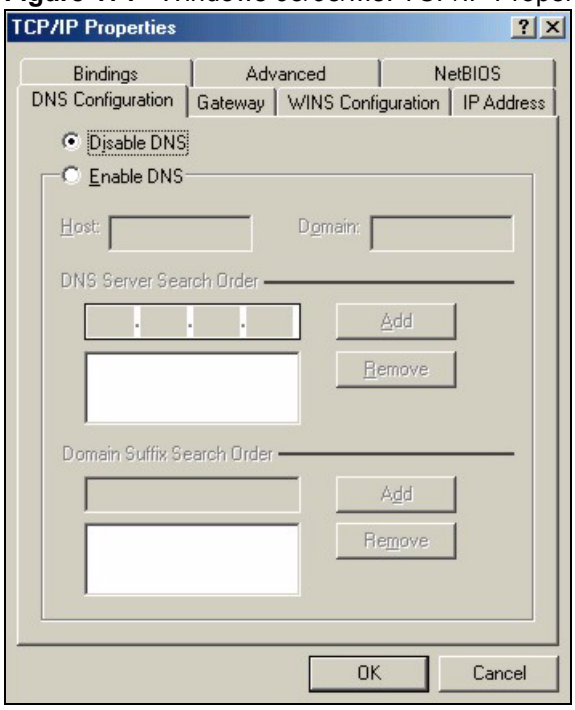
1. In the **Network** window **Configuration** tab, select your network adapter's TCP/IP entry and click **Properties**
2. Click the **IP Address** tab.
   - If your IP address is dynamic, select **Obtain an IP address automatically**.
   - If you have a static IP address, select **Specify an IP address** and type your information into the **IP Address** and **Subnet Mask** fields.

Figure 170 Windows 95/98/Me: TCP/IP Properties: IP Address


TCP/IP Properties
Bindings
Advanced
NetBIOS
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
Subnet Mask:
Detect connection to network media
OK
Cancel

3. Click the **DNS** Configuration tab.
   - If you do not know your DNS information, select **Disable DNS**.
   - If you know your DNS information, select **Enable DNS** and type the information in the fields below (you may not need to fill them all in).

Figure 171 Windows 95/98/Me: TCP/IP Properties: DNS Configuration



4 Click the **Gateway** tab.
   - If you do not know your gateway's IP address, remove previously installed gateways.
   - If you have a gateway IP address, type it in the **New gateway field** and click **Add**.
5 Click **OK** to save and close the **TCP/IP Properties** window.
6 Click **OK** to close the **Network** window. Insert the Windows CD if prompted.
7 Turn on your Switch and restart your computer when prompted.

Verifying Settings

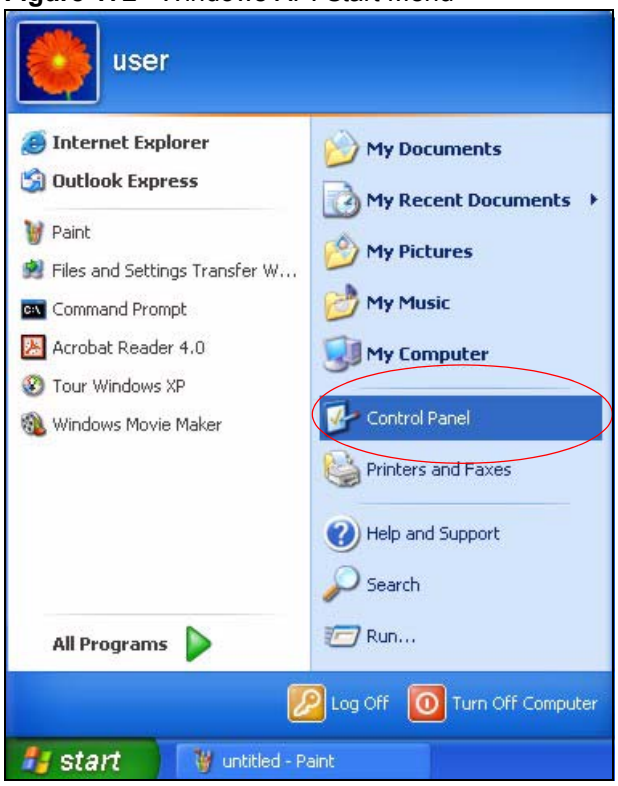
1 Click **Start** and then **Run**.
2 In the **Run** window, type "winipcfg" and then click **OK** to open the **IP Configuration** window.
3 Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

Windows 2000/NT/XP

The following example figures use the default Windows XP GUI theme.

1 Click **start** (**Start** in Windows 2000/NT), **Settings**, **Control Panel**.

Figure 172 Windows XP: Start Menu



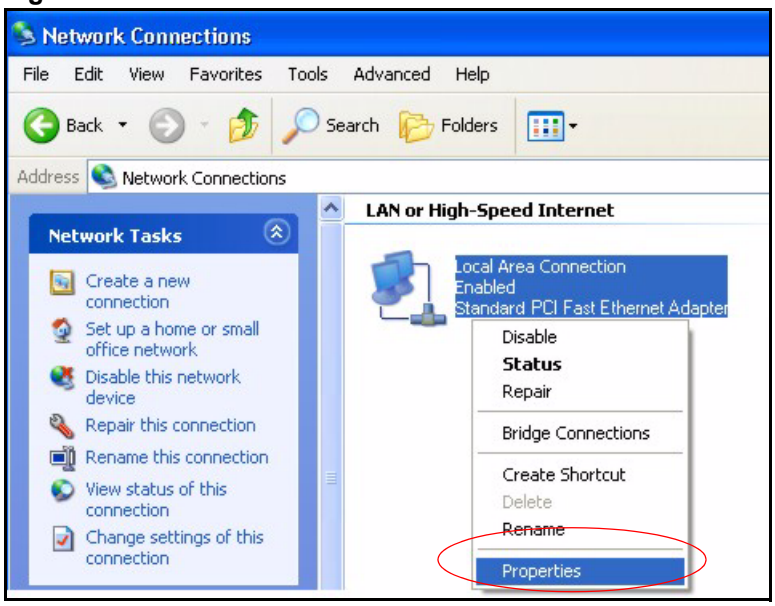
2 In the **Control Panel**, double-click **Network Connections** (**Network and Dial-up Connections** in Windows 2000/NT).

Figure 173 Windows XP: Control Panel



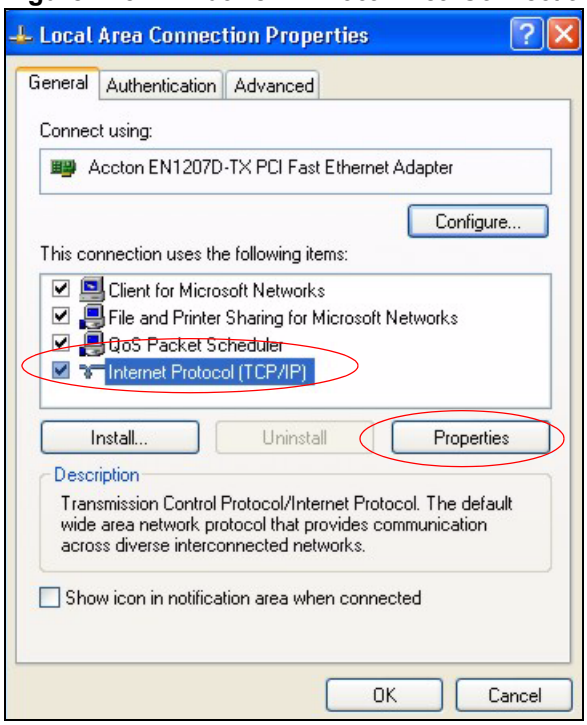
3 Right-click **Local Area Connection** and then click **Properties**.

Figure 174 Windows XP: Control Panel: Network Connections: Properties



4 Select **Internet Protocol (TCP/IP)** (under the **General** tab in Win XP) and then click **Properties**.

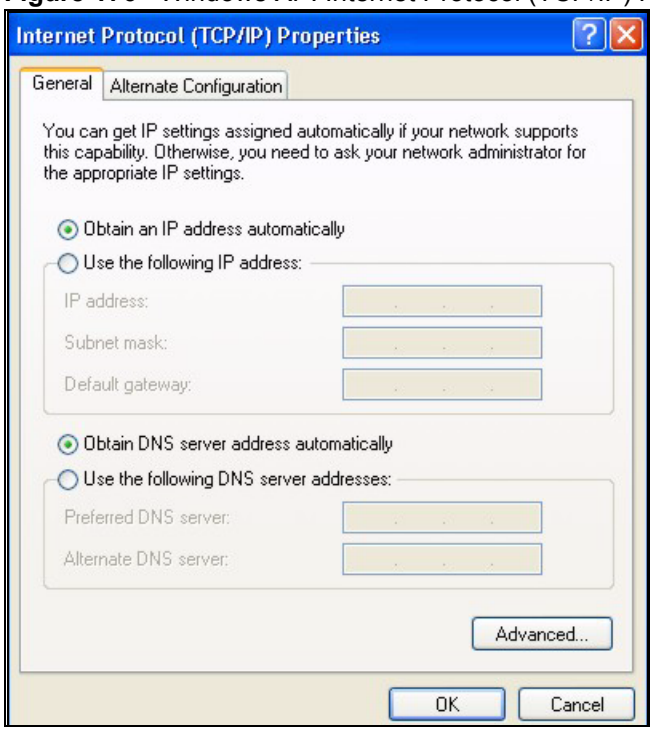
Figure 175 Windows XP: Local Area Connection Properties


Local Area Connection Properties
General Authentication Advanced
Connect using:
Accton EN1207D-TX PCI Fast Ethernet Adapter
Configure...
This connection uses the following items:
Client for Microsoft Networks
File and Printer Sharing for Microsoft Networks
QoS Packet Scheduler
Internet Protocol (TCP/IP)
Install... Uninstall Properties
Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
Show icon in notification area when connected
OK Cancel

5 The **Internet Protocol TCP/IP Properties** window opens (the **General tab** in Windows XP).

- If you have a dynamic IP address click **Obtain an IP address automatically**.
- If you have a static IP address click **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields.
- Click **Advanced**.

Figure 176 Windows XP: Internet Protocol (TCP/IP) Properties

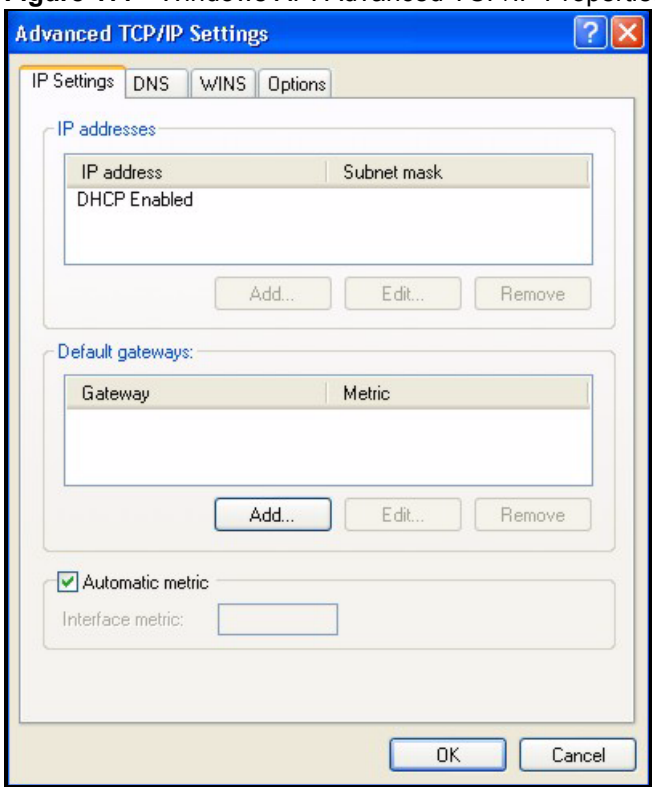

Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

6 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

Figure 177 Windows XP: Advanced TCP/IP Properties

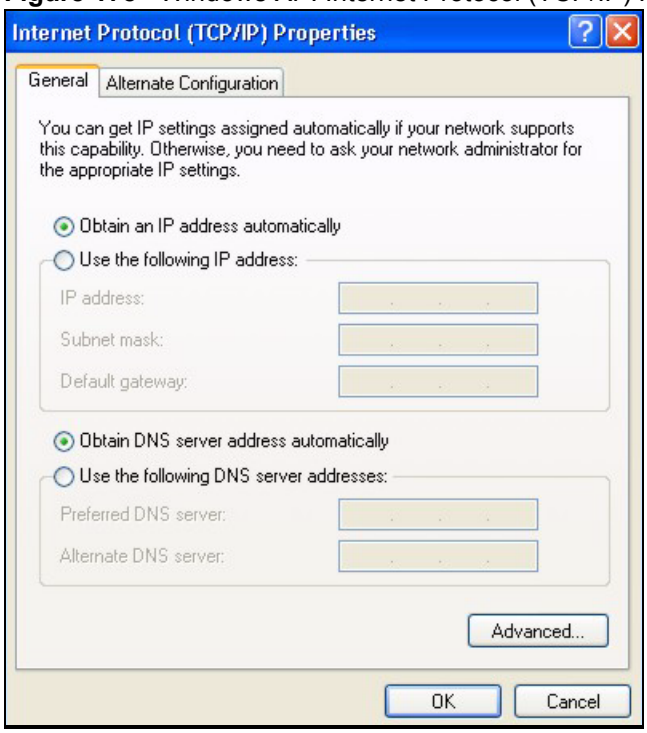


7 In the **Internet Protocol TCP/IP Properties** window (the **General** tab in Windows XP):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 178 Windows XP: Internet Protocol (TCP/IP) Properties


Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

8 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

9 Click **Close** (**OK** in Windows 2000/NT) to close the **Local Area Connection Properties** window.

10 Close the **Network Connections** window (**Network and Dial-up Connections** in Windows 2000/NT).

11 Turn on your Switch and restart your computer (if prompted).

Verifying Settings

1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

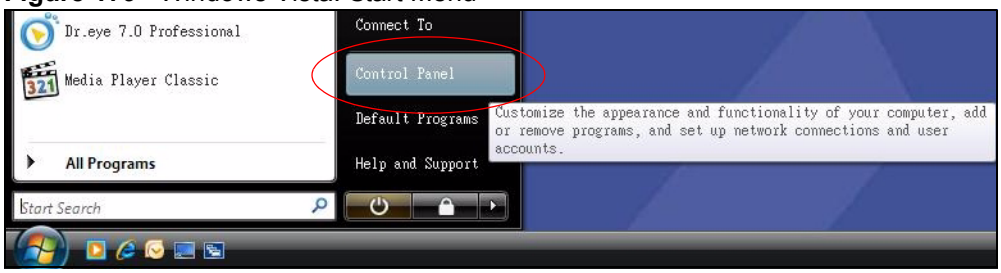
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Windows Vista

This section shows screens from Windows Vista Enterprise Version 6.0.

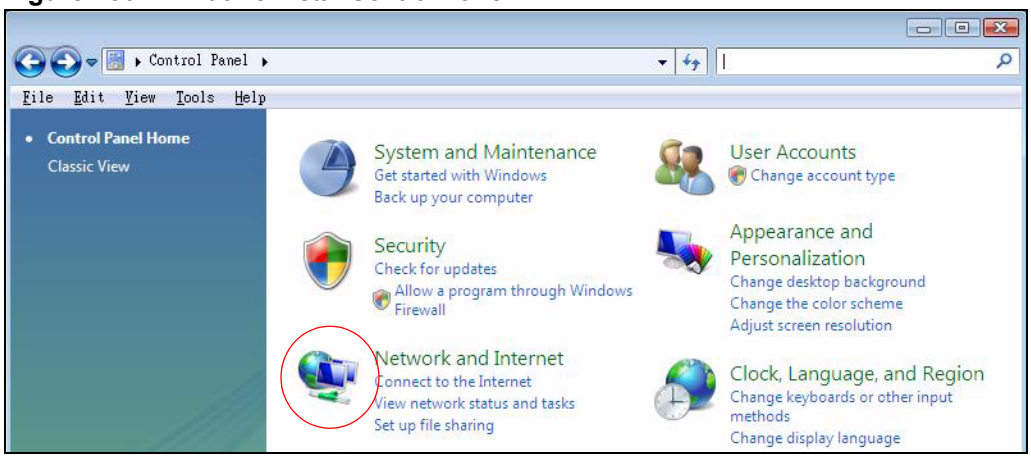
1 Click the **Start** icon, **Control Panel**.

Figure 179 Windows Vista: Start Menu


Dr.eye 7.0 Professional
Media Player Classic
All Programs
Start Search
Connect To
Control Panel
Default Programs
Help and Support
Customize the appearance and functionality of your computer, add or remove programs, and set up network connections and user accounts.

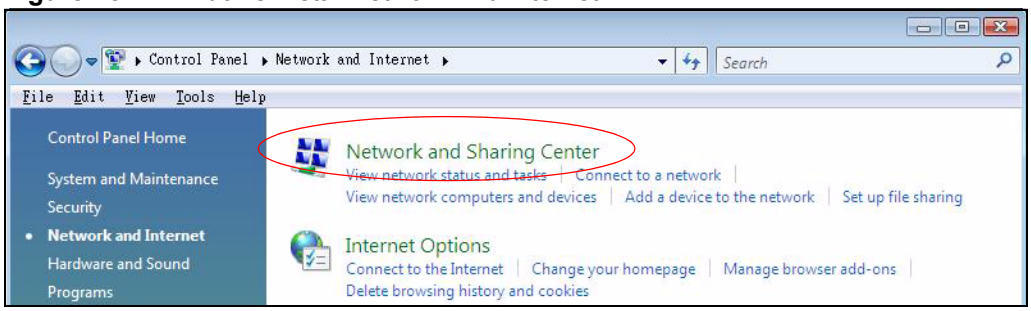
2 In the **Control Panel**, double-click **Network and Internet**.

Figure 180 Windows Vista: Control Panel



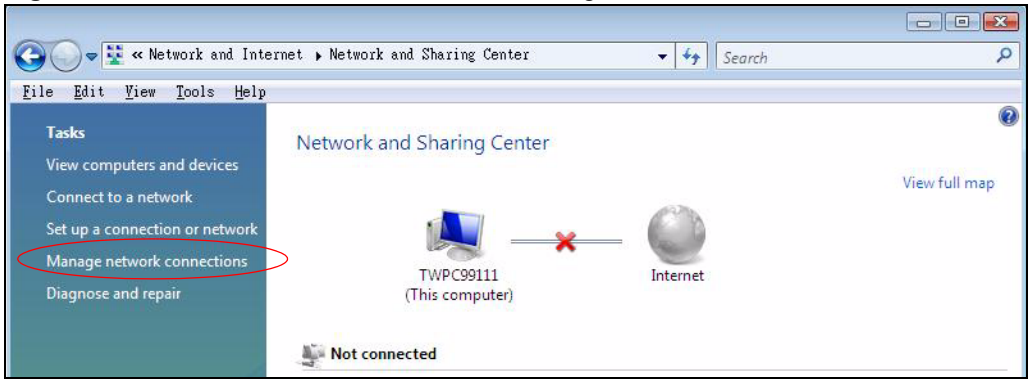
3 Click **Network and Sharing Center**.

Figure 181 Windows Vista: Network And Internet



4 Click **Manage network connections**.

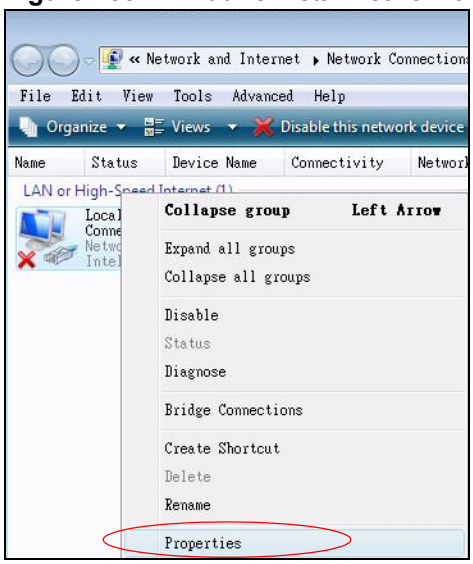
Figure 182 Windows Vista: Network and Sharing Center



5 Right-click **Local Area Connection** and then click **Properties**.

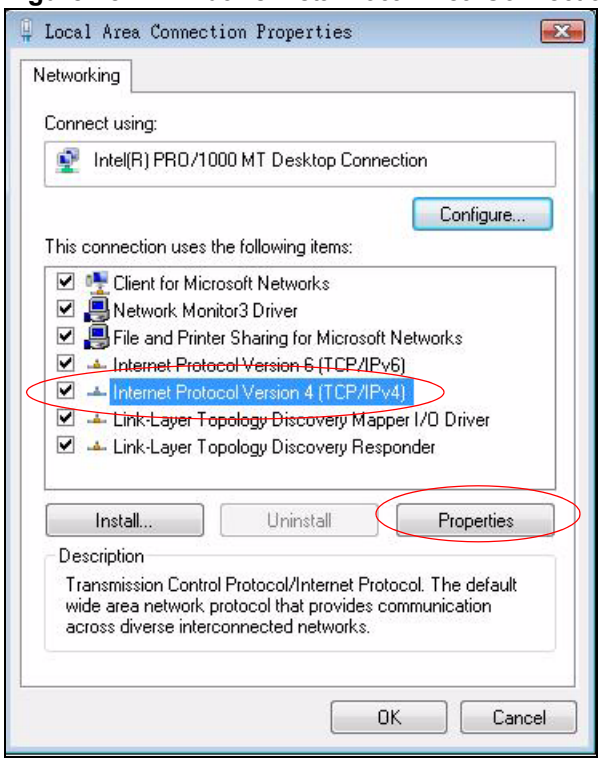
During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

Figure 183 Windows Vista: Network and Sharing Center



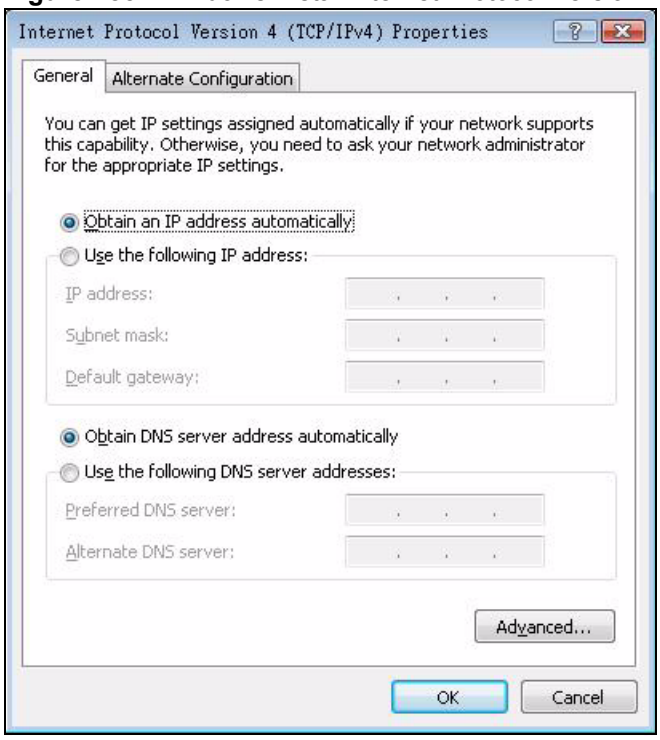
6 Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.

Figure 184 Windows Vista: Local Area Connection Properties



7 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens (the **General tab**).
- If you have a dynamic IP address click **Obtain an IP address automatically**.
- If you have a static IP address click **Use the following IP address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields.
- Click **Advanced**.

Figure 185 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties

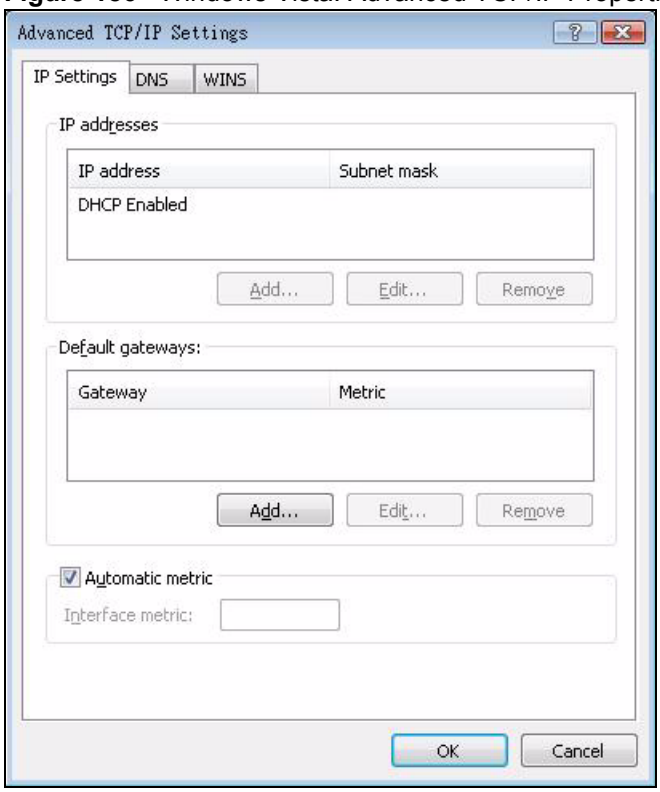

Internet Protocol Version 4 (TCP/IPv4) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

8 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

Figure 186 Windows Vista: Advanced TCP/IP Properties

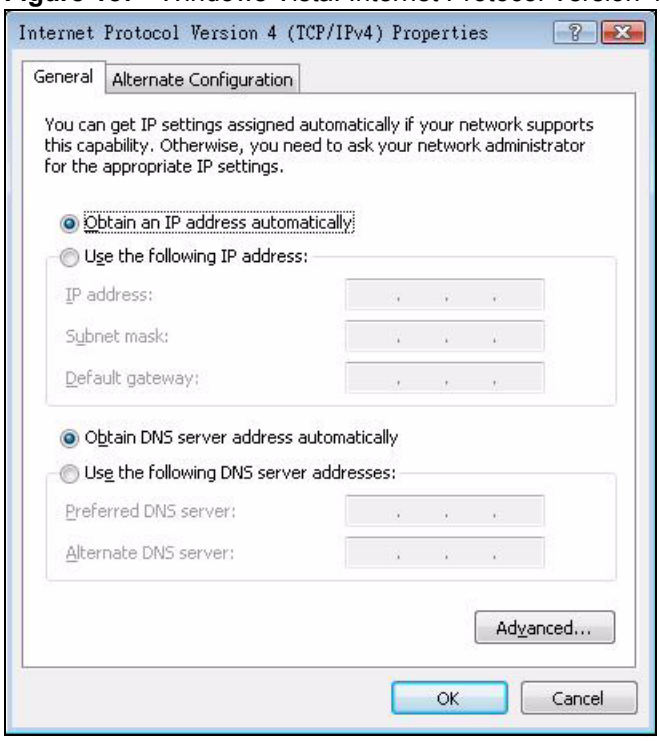


9 In the **Internet Protocol Version 4 (TCP/IPv4) Properties** window, (the **General tab**):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 187 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties


Internet Protocol Version 4 (TCP/IPv4) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

10 Click **OK** to close the **Internet Protocol Version 4 (TCP/IPv4) Properties** window.

11 Click **Close** to close the **Local Area Connection Properties** window.

12 Close the **Network Connections** window.

13 Turn on your Switch and restart your computer (if prompted).

Verifying Settings

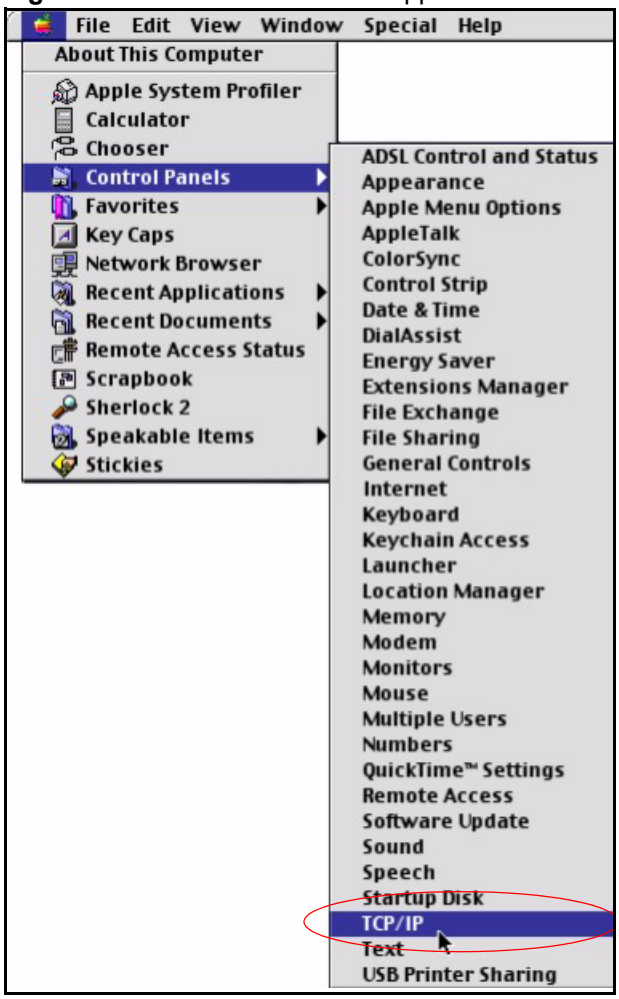
1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Macintosh OS 8/9

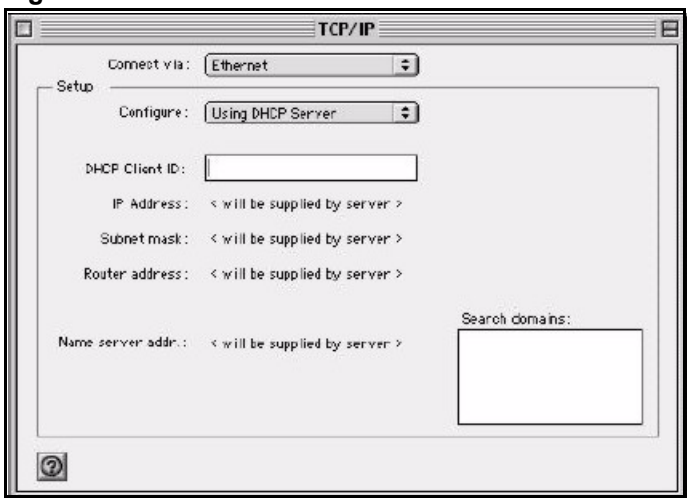
1 Click the **Apple** menu, **Control Panel** and double-click **TCP/IP** to open the **TCP/IP Control Panel**.

Figure 188 Macintosh OS 8/9: Apple Menu



2 Select **Ethernet built-in** from the **Connect via** list.

Figure 189 Macintosh OS 8/9: TCP/IP



3 For dynamically assigned settings, select **Using DHCP Server** from the **Configure:** list.

4 For statically assigned settings, do the following:

- From the **Configure** box, select **Manually**.

- Type your IP address in the **IP Address** box.
- Type your subnet mask in the **Subnet mask** box.
- Type the IP address of your Switch in the **Router address** box.

5 Close the **TCP/IP Control Panel**.

6 Click **Save** if prompted, to save changes to your configuration.

7 Turn on your Switch and restart your computer (if prompted).

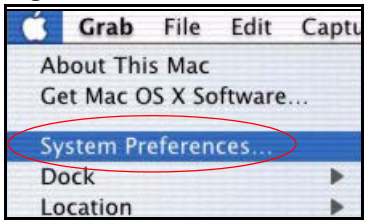
Verifying Settings

Check your TCP/IP properties in the **TCP/IP Control Panel** window.

Macintosh OS X

1 Click the **Apple** menu, and click **System Preferences** to open the **System Preferences** window.

Figure 190 Macintosh OS X: Apple Menu

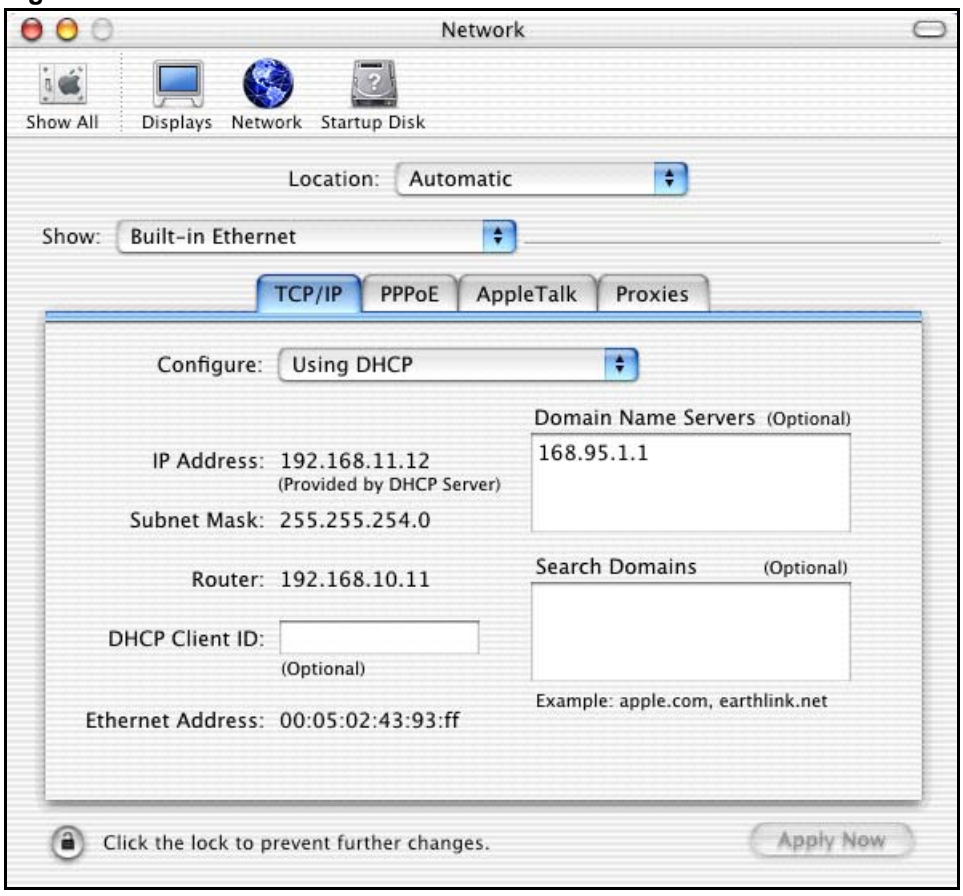


2 Click **Network** in the icon bar.

- Select **Automatic** from the **Location** list.
- Select **Built-in Ethernet** from the **Show** list.
- Click the **TCP/IP** tab.

3 For dynamically assigned settings, select **Using DHCP** from the **Configure** list.

Figure 191 Macintosh OS X: Network



4 For statically assigned settings, do the following:
   - From the **Configure** box, select **Manually**.
   - Type your IP address in the **IP Address** box.
   - Type your subnet mask in the **Subnet mask** box.
   - Type the IP address of your Switch in the **Router address** box.
5 Click **Apply Now** and close the window.
6 Turn on your Switch and restart your computer (if prompted).

Verifying Settings

Check your TCP/IP properties in the **Network** window.

Linux

This section shows you how to configure your computer's TCP/IP settings in Red Hat Linux 9.0. Procedure, screens and file location may vary depending on your Linux distribution and release version.

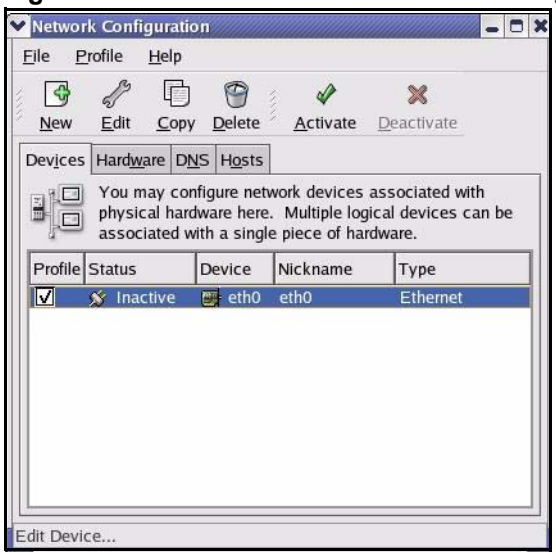
Make sure you are logged in as the root administrator.

Using the K Desktop Environment (KDE)

Follow the steps below to configure your computer IP address using the KDE.

1 Click the Red Hat button (located on the bottom left corner), select **System Setting** and click **Network**.

Figure 192 Red Hat 9.0: KDE: Network Configuration: Devices



2 Double-click on the profile of the network card you wish to configure. The **Ethernet Device General** screen displays as shown.

Figure 193 Red Hat 9.0: KDE: Ethernet Device: General

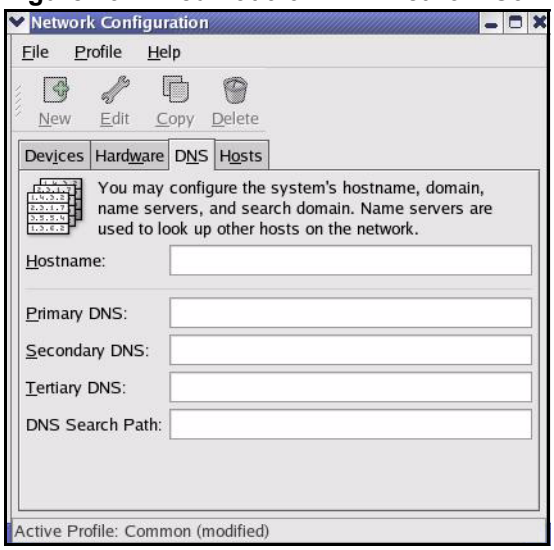


- If you have a dynamic IP address, click **Automatically obtain IP address settings with** and select **dhcp** from the drop down list.
- If you have a static IP address, click **Statically set IP Addresses** and fill in the **Address**, **Subnet mask**, and **Default Gateway Address** fields.

3 Click **OK** to save the changes and close the **Ethernet Device General** screen.

4 If you know your DNS server IP address(es), click the **DNS** tab in the **Network Configuration** screen. Enter the DNS server information in the fields provided.

Figure 194 Red Hat 9.0: KDE: Network Configuration: DNS



5 Click the **Devices** tab.

6 Click the **Activate** button to apply the changes. The following screen displays. Click **Yes to save the changes in all screens.**

Figure 195 Red Hat 9.0: KDE: Network Configuration: Activate


Question
redhat-config-network:
You have made some changes in your configuration.
To activate the network device eth0, the changes have to be saved.
Do you want to continue?
No
Yes

7 After the network card restart process is complete, make sure the **Status** is **Active** in the **Network Configuration** screen.

Using Configuration Files

Follow the steps below to edit the network configuration files and set your computer IP address.

1 Assuming that you have only one network card on the computer, locate the `ifconfig-eth0` configuration file (where `eth0` is the name of the Ethernet card). Open the configuration file with any plain text editor.

- If you have a dynamic IP address, enter **`dhcp`** in the `BOOTPROTO=` field. The following figure shows an example.

Figure 196 Red Hat 9.0: Dynamic IP Address Setting in ifconfig-eth0

```
DEVICE=eth0
ONBOOT=yes
BOOTPROTO=dhcp
USERCTL=no
PEERDNS=yes
TYPE=Ethernet
```

- If you have a static IP address, enter **static** in the BOOTPROTO= field. Type IPADDR= followed by the IP address (in dotted decimal notation) and type NETMASK= followed by the subnet mask. The following example shows an example where the static IP address is 192.168.1.10 and the subnet mask is 255.255.255.0.

Figure 197 Red Hat 9.0: Static IP Address Setting in ifconfig-eth0

```
DEVICE=eth0
ONBOOT=yes
BOOTPROTO=static
IPADDR=192.168.1.10
NETMASK=255.255.255.0
USERCTL=no
PEERDNS=yes
TYPE=Ethernet
```

2 If you know your DNS server IP address(es), enter the DNS server information in the `resolv.conf` file in the `/etc` directory. The following figure shows an example where two DNS server IP addresses are specified.

Figure 198 Red Hat 9.0: DNS Settings in resolv.conf

```
nameserver 172.23.5.1
nameserver 172.23.5.2
```

3 After you edit and save the configuration files, you must restart the network card. Enter `./network restart` in the `/etc/rc.d/init.d` directory. The following figure shows an example.

Figure 199 Red Hat 9.0: Restart Ethernet Card

```
[root@localhost init.d]# network restart

Shutting down interface eth0:                [OK]
Shutting down loopback interface:            [OK]
Setting network parameters:                  [OK]
Bringing up loopback interface:              [OK]
Bringing up interface eth0:                  [OK]
```

Verifying Settings

Enter `ifconfig` in a terminal screen to check your TCP/IP properties.

Figure 200 Red Hat 9.0: Checking TCP/IP Properties

```
[root@localhost]# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:50:BA:72:5B:44
          inet addr:172.23.19.129  Bcast:172.23.19.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:717 errors:0 dropped:0 overruns:0 frame:0
          TX packets:13 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:730412 (713.2 Kb)  TX bytes:1570 (1.5 Kb)
          Interrupt:10 Base address:0x1000
[root@localhost]#
```

B

Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

Internet Explorer Pop-up Blockers

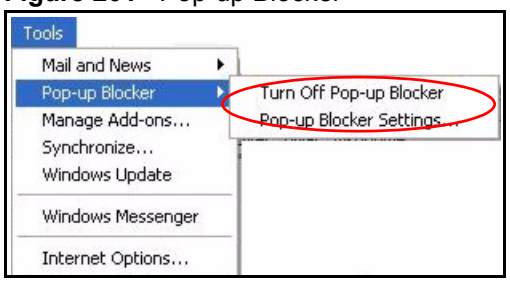
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

Disable Pop-up Blockers

1 In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

Figure 201 Pop-up Blocker

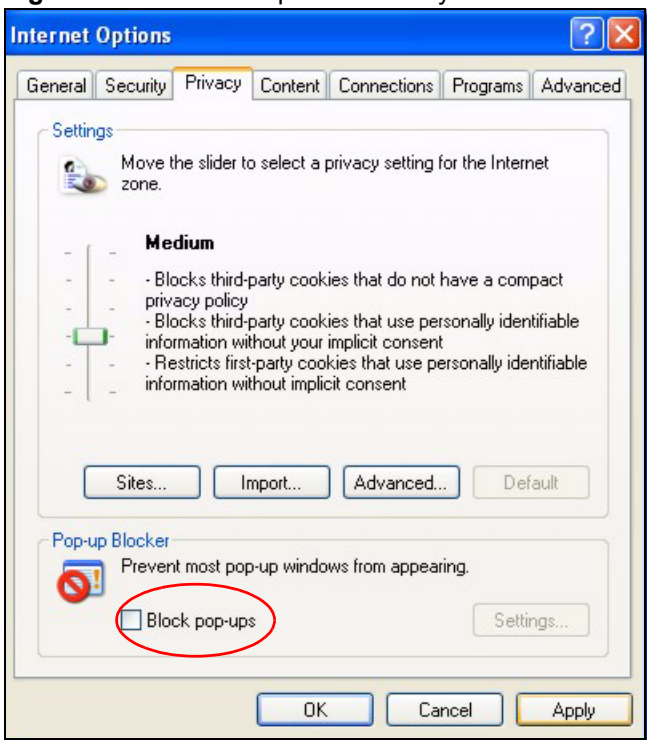


You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1 In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.

2 Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 202 Internet Options: Privacy



3 Click **Apply** to save this setting.

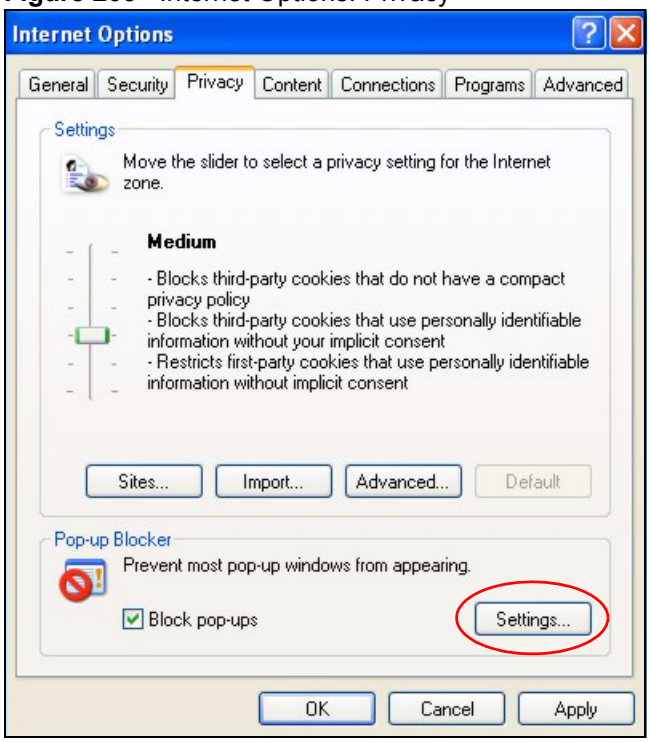
Enable Pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

2 Select **Settings…**to open the **Pop-up Blocker Settings** screen.

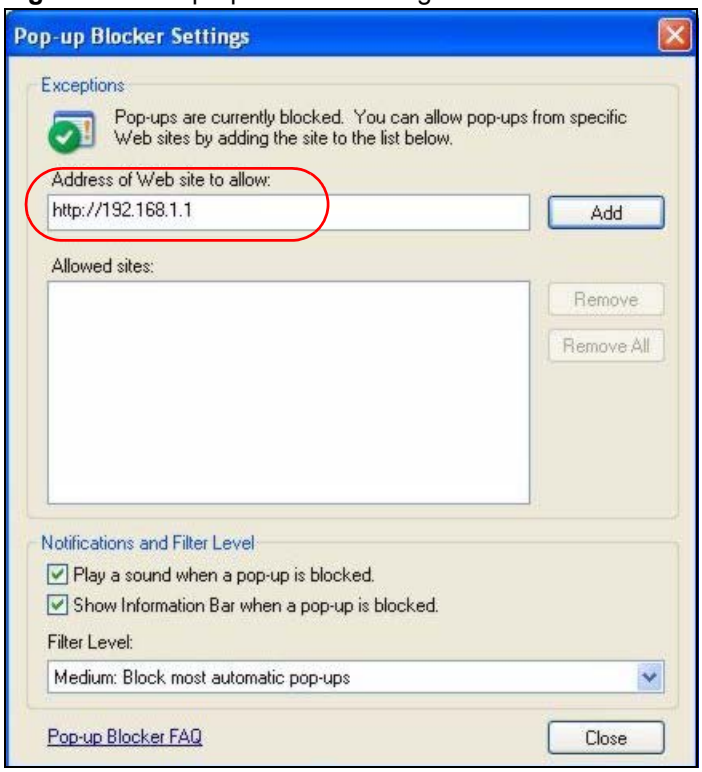
Figure 203 Internet Options: Privacy



3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix "http://". For example, http://192.168.167.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 204 Pop-up Blocker Settings


Pop-up Blocker Settings
Exceptions
Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.
Address of Web site to allow:
http://192.168.1.1
Add
Allowed sites:
Remove
Remove All
Notifications and Filter Level
Play a sound when a pop-up is blocked.
Show Information Bar when a pop-up is blocked.
Filter Level:
Medium: Block most automatic pop-ups
Pop-up Blocker FAQ
Close

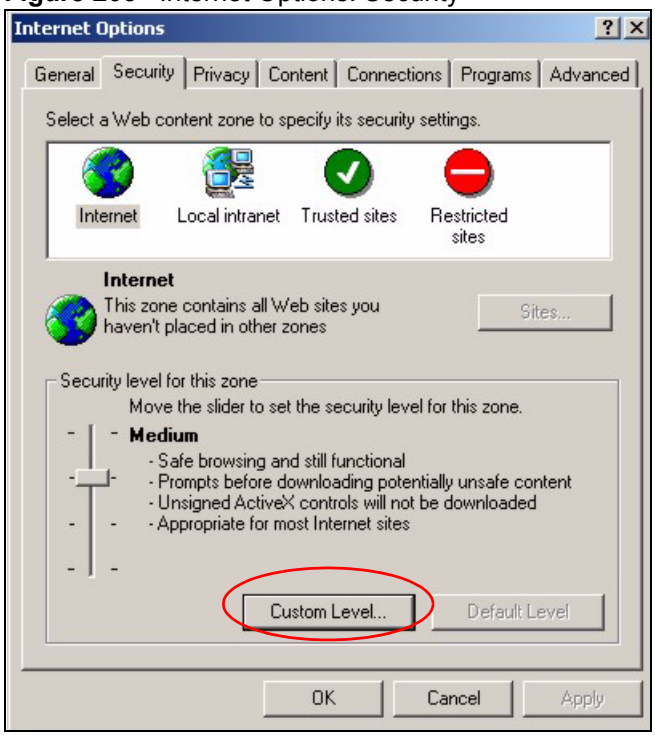
5 Click **Close** to return to the **Privacy** screen.
6 Click **Apply** to save this setting.

JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

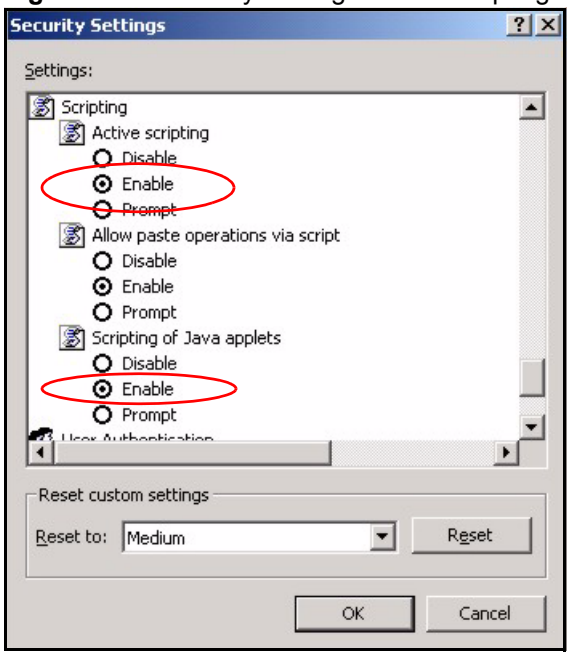
1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 205 Internet Options: Security



2 Click the **Custom Level...** button.
3 Scroll down to **Scripting**.
4 Under **Active scripting** make sure that **Enable** is selected (the default).
5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).
6 Click **OK** to close the window.

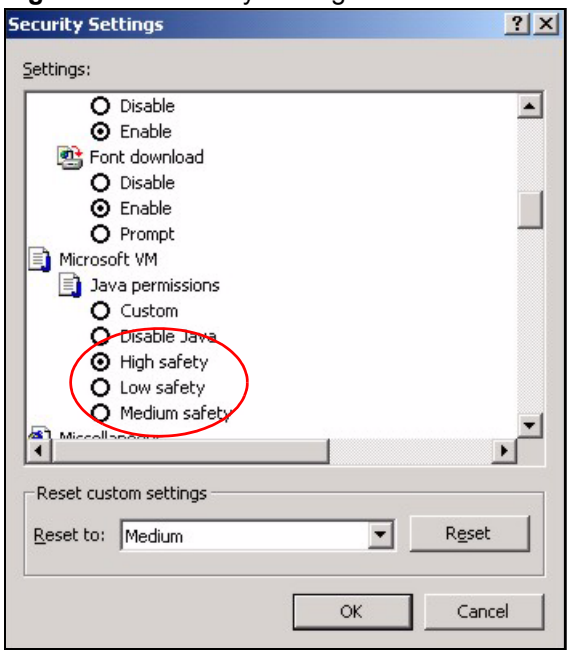
Figure 206 Security Settings - Java Scripting



Java Permissions

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.
2. Click the **Custom Level...** button.
3. Scroll down to **Microsoft VM**.
4. Under **Java permissions** make sure that a safety level is selected.
5. Click **OK** to close the window.

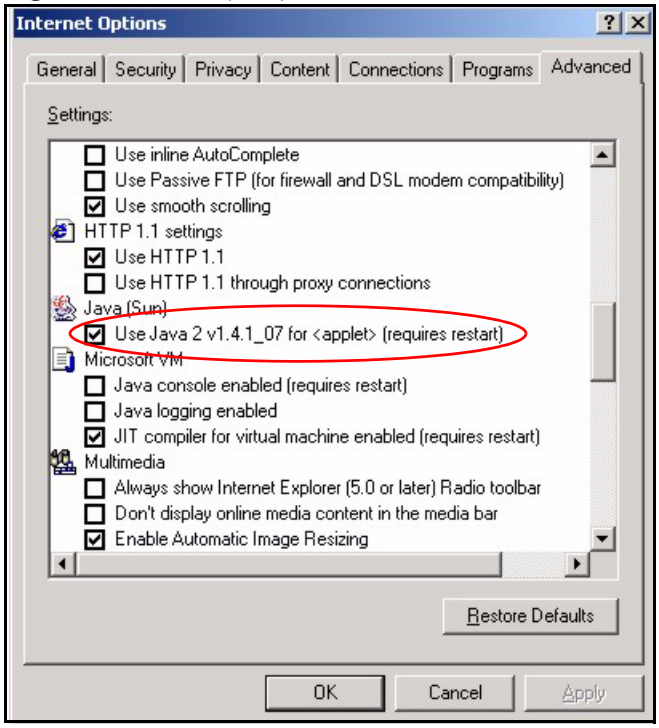
Figure 207 Security Settings - Java



JAVA (Sun)

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.
2 Make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.
3 Click **OK** to close the window.

Figure 208 Java (Sun)

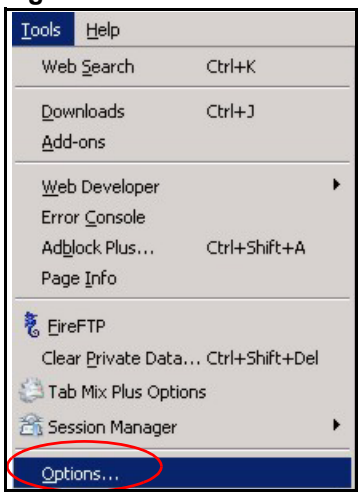


Mozilla Firefox

Mozilla Firefox 2.0 screens are used here. Screens for other versions may vary.

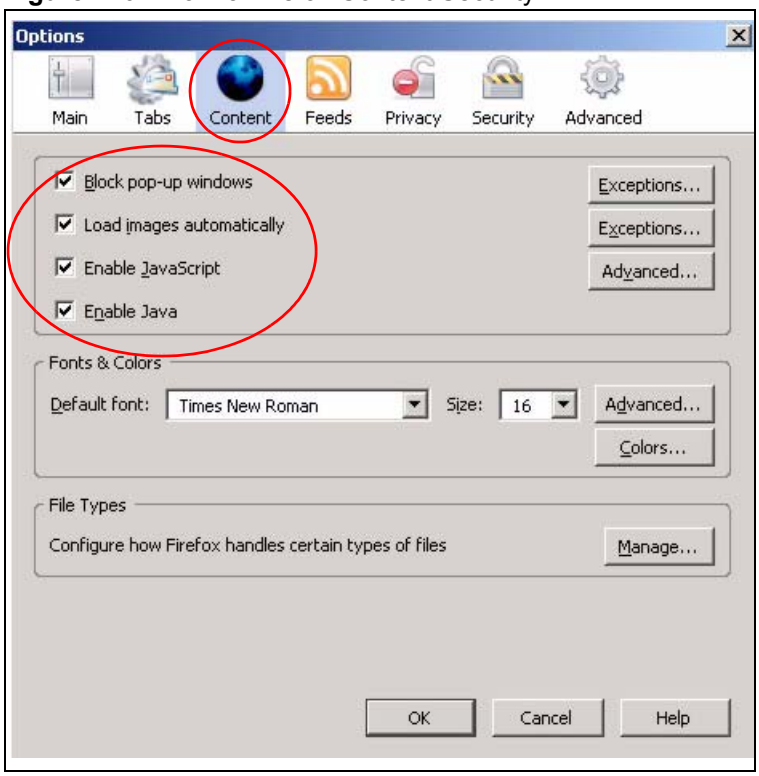
You can enable Java, Javascripts and pop-ups in one screen. Click **Tools,** then click **Options** in the screen that appears.

Figure 209 Mozilla Firefox: Tools > Options



Click **Content** to show the screen below. Select the check boxes as shown in the following screen.

Figure 210 Mozilla Firefox Content Security



C

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

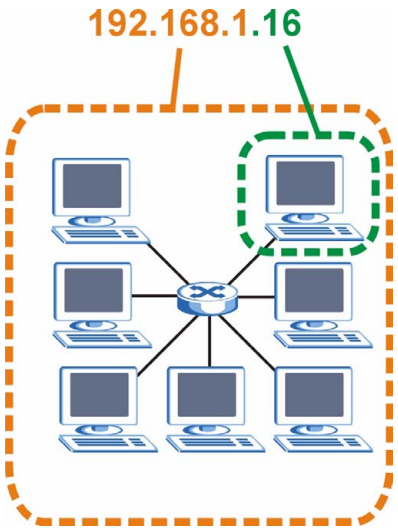
Structure

An IP address is made up of four parts, written in dotted decimal notation (for example, 192.168.1.1). Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 211 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term "subnet" is short for "sub-network".

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 125 IP Address Network Number and Host ID Example

	1ST OCTET: (192)	2ND OCTET: (168)	3RD OCTET: (1)	4TH OCTET (2)
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a "1" value). For example, an "8-bit mask" means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 126 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 127 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} - 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} - 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} - 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} - 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 128 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128

Table 128 Alternative Subnet Mask Notation (continued)

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

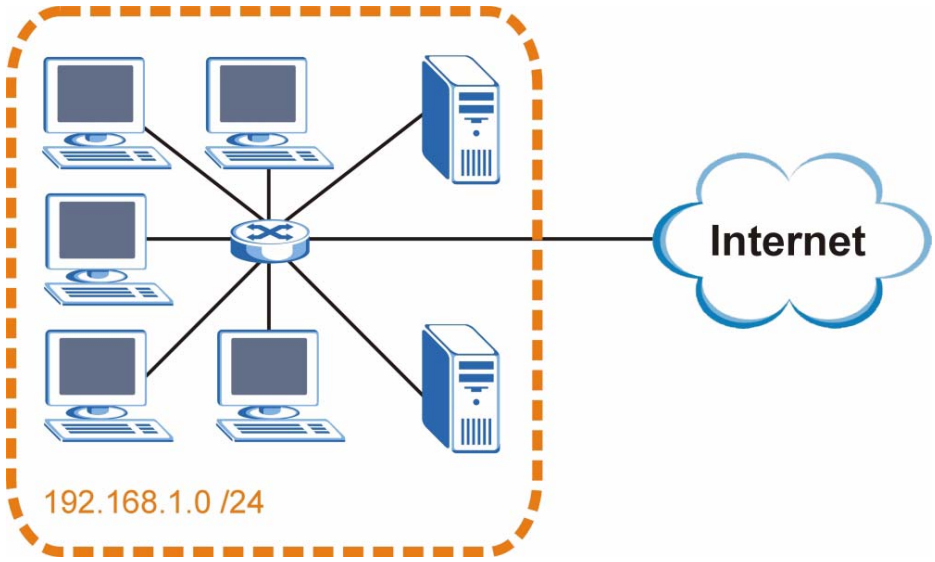
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of $2^8 - 2$ or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 212 Subnetting Example: Before Subnetting

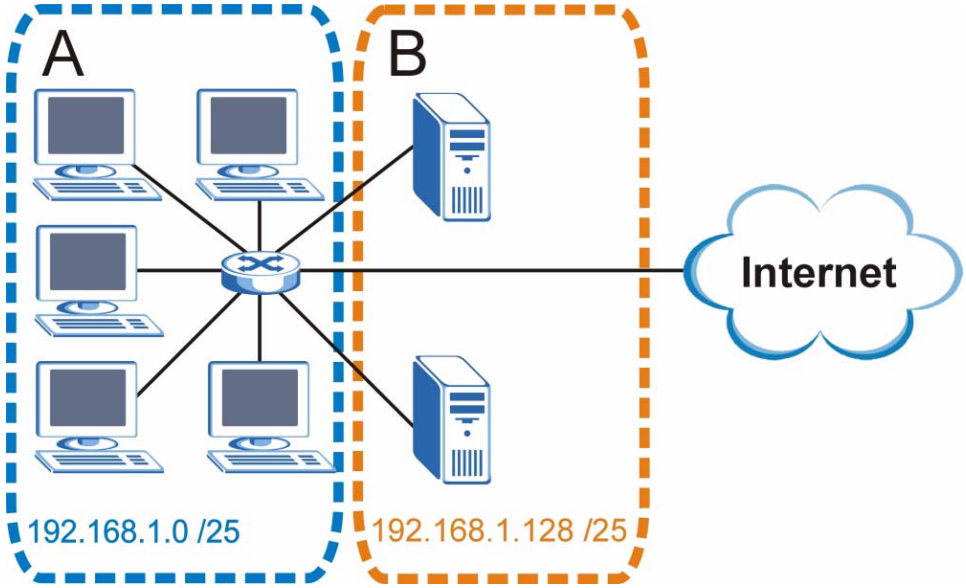


You can "borrow" one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The "borrowed" host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 213 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of $2^7 - 2$ or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 129 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 130 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 131 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 132 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 133 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127

Table 133 Eight Subnets (continued)

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 134 24-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 135 16-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6

Table 135 16-bit Network Number Subnet Planning (continued)

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the Switch.

Once you have decided on the network number, pick an IP address for your Switch that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your Switch will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the Switch unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, Address Allocation for Private Internets and RFC 1466, Guidelines for Management of IP Address Space.

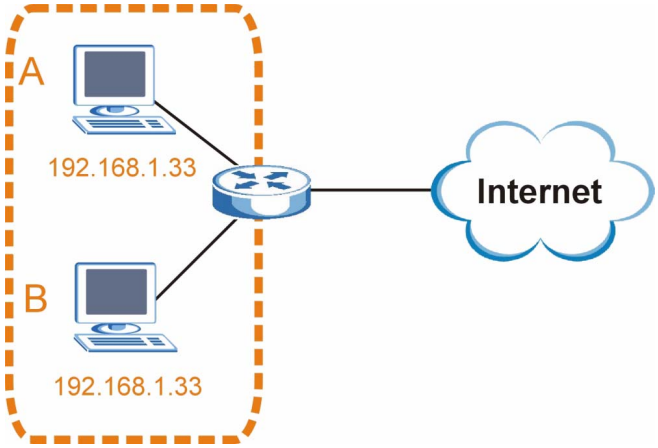
IP Address Conflicts

Each device on a network must have a unique IP address. Devices with duplicate IP addresses on the same network will not be able to access the Internet or other resources. The devices may also be unreachable through the network.

Conflicting Computer IP Addresses Example

More than one device can not use the same IP address. In the following example computer **A** has a static (or fixed) IP address that is the same as the IP address that a DHCP server assigns to computer **B** which is a DHCP client. Neither can access the Internet. This problem can be solved by assigning a different static IP address to computer **A** or setting computer **A** to obtain an IP address automatically.

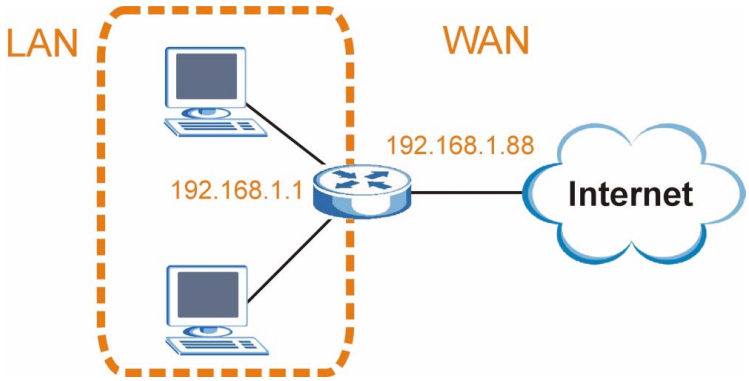
Figure 214 Conflicting Computer IP Addresses Example



Conflicting Router IP Addresses Example

Since a router connects different networks, it must have interfaces using different network numbers. For example, if a router is set between a LAN and the Internet (WAN), the router's LAN and WAN addresses must be on different subnets. In the following example, the LAN and WAN are on the same subnet. The LAN computers cannot access the Internet because the router cannot route between networks.

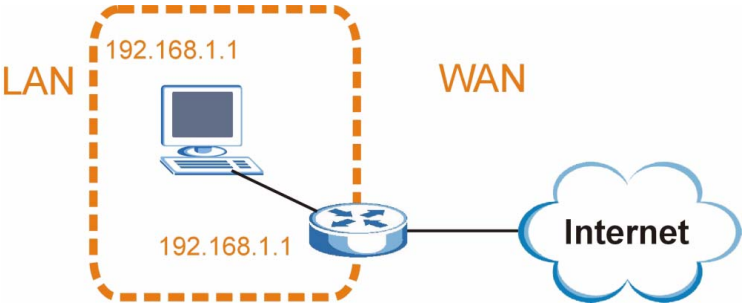
Figure 215 Conflicting Computer IP Addresses Example



Conflicting Computer and Router IP Addresses Example

More than one device can not use the same IP address. In the following example, the computer and the router's LAN port both use 192.168.1.1 as the IP address. The computer cannot access the Internet. This problem can be solved by assigning a different IP address to the computer or the router's LAN port.

Figure 216 Conflicting Computer and Router IP Addresses Example



D

Common Services

The following table lists some commonly-used services and their associated protocols and port numbers. For a comprehensive list of port numbers, ICMP type/code numbers and services, visit the IANA (Internet Assigned Number Authority) web site.

- **Name**: This is a short, descriptive name for the service. You can use this one or create a different one, if you like.
- **Protocol**: This is the type of IP protocol used by the service. If this is **TCP/UDP**, then the service uses the same port number with TCP and UDP. If this is **USER-DEFINED**, the **Port(s)** is the IP protocol number, not the port number.
- **Port(s)**: This value depends on the **Protocol**. Please refer to RFC 1700 for further information about port numbers.
  - If the **Protocol** is **TCP**, **UDP**, or **TCP/UDP**, this is the IP port number.
  - If the **Protocol** is **USER**, this is the IP protocol number.
- **Description**: This is a brief explanation of the applications that use this service or the situations in which this service is used.

Table 136 Commonly Used Services

NAME	PROTOCOL	PORT(S)	DESCRIPTION
AH (IPSEC_TUNNEL)	User-Defined	51	The IPSEC AH (Authentication Header) tunneling protocol uses this service.
AIM/New-ICQ	TCP	5190	AOL's Internet Messenger service. It is also used as a listening port by ICQ.
AUTH	TCP	113	Authentication protocol used by some servers.
BGP	TCP	179	Border Gateway Protocol.
BOOTP_CLIENT	UDP	68	DHCP Client.
BOOTP_SERVER	UDP	67	DHCP Server.
CU-SEEME	TCP UDP	7648 24032	A popular videoconferencing solution from White Pines Software.
DNS	TCP/UDP	53	Domain Name Server, a service that matches web names (for example www.zyxel.com) to IP numbers.
ESP (IPSEC_TUNNEL)	User-Defined	50	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
FINGER	TCP	79	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.

Table 136 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
FTP	TCP TCP	20 21	File Transfer Program, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
H.323	TCP	1720	NetMeeting uses this protocol.
HTTP	TCP	80	Hyper Text Transfer Protocol - a client/ server protocol for the world wide web.
HTTPS	TCP	443	HTTPS is a secured http session often used in e-commerce.
ICMP	User-Defined	1	Internet Control Message Protocol is often used for diagnostic or routing purposes.
ICQ	UDP	4000	This is a popular Internet chat program.
IGMP (MULTICAST)	User-Defined	2	Internet Group Management Protocol is used when sending packets to a specific group of hosts.
IKE	UDP	500	The Internet Key Exchange algorithm is used for key distribution and management.
IRC	TCP/UDP	6667	This is another popular Internet chat program.
MSN Messenger	TCP	1863	Microsoft Networks' messenger service uses this protocol.
NEW-ICQ	TCP	5190	An Internet chat program.
NEWS	TCP	144	A protocol for news groups.
NFS	UDP	2049	Network File System - NFS is a client/ server distributed file service that provides transparent file sharing for network environments.
NNTP	TCP	119	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING	User-Defined	1	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
POP3	TCP	110	Post Office Protocol version 3 lets a client computer get e-mail from a POP3 server through a temporary connection (TCP/IP or other).
PPTP	TCP	1723	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL (GRE)	User-Defined	47	PPTP (Point-to-Point Tunneling Protocol) enables secure transfer of data over public networks. This is the data channel.
RCMD	TCP	512	Remote Command Service.
REAL_AUDIO	TCP	7070	A streaming audio service that enables real time sound over the web.
REXEC	TCP	514	Remote Execution Daemon.
RLOGIN	TCP	513	Remote Login.
RTELNET	TCP	107	Remote Telnet.

Table 136 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
RTSP	TCP/UDP	554	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP	TCP	115	Simple File Transfer Protocol.
SMTP	TCP	25	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.
SNMP	TCP/UDP	161	Simple Network Management Program.
SNMP-TRAPS	TCP/UDP	162	Traps for use with the SNMP (RFC:1215).
SQL-NET	TCP	1521	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSH	TCP/UDP	22	Secure Shell Remote Login Program.
STRM WORKS	UDP	1558	Stream Works Protocol.
SYSLOG	UDP	514	Syslog allows you to send system logs to a UNIX server.
TACACS	UDP	49	Login Host Protocol used for (Terminal Access Controller Access Control System).
TELNET	TCP	23	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.
TFTP	UDP	69	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE	TCP	7000	Another videoconferencing solution.

E

Importing Certificates

This appendix shows importing certificates examples using Netscape Navigator and Internet Explorer 5. This appendix uses the ZyWALL 70 as an example. Other models should be similar.

Import Switch Certificates into Netscape Navigator

In Netscape Navigator, you can permanently trust the Switch's server certificate by importing it into your operating system as a trusted certification authority.

Select **Accept This Certificate Permanently** in the following screen to do this.

Figure 217 Security Certificate


Possible reasons for this error:
- Your browser does not recognize the Certificate Authority that issued the site's certificate.
- The site's certificate is incomplete due to a server misconfiguration.
- You are connected to a site pretending to be ZyWALL 70 Factory Default Certificate, possibly to obtain your confidential information.
Please notify the site's webmaster about this problem.
Before accepting this certificate, you should examine this site's certificate carefully. Are you willing to to accept this certificate for the purpose of identifying the Web site ZyWALL 70 Factory Default Certificate?
Examine Certificate...
Accept this certificate permanently
Accept this certificate temporarily for this session
Do not accept this certificate and do not connect to this Web site
OK
Cancel
Help

Importing the Switch's Certificate into Internet Explorer

For Internet Explorer to trust a self-signed certificate from the Switch, simply import the self-signed certificate into your operating system as a trusted certification authority.

To have Internet Explorer trust a Switch certificate issued by a certificate authority, import the certificate authority's certificate into your operating system as a trusted certification authority.

The following example procedure shows how to import the Switch's (self-signed) server certificate into your operating system as a trusted certification authority.

1 In Internet Explorer, double click the lock shown in the following screen.

Figure 218 Login Screen



2 Click **Install Certificate** to open the **Install Certificate** wizard.

Figure 219 Certificate General Information before Import



3 Click **Next** to begin the **Install Certificate** wizard.

Figure 220 Certificate Import Wizard 1


Certificate Import Wizard
Welcome to the Certificate Import Wizard
This wizard helps you copy certificates, certificate trust lists, and certificate revocation lists from your disk to a certificate store.
A certificate, which is issued by a certification authority, is a confirmation of your identity and contains information used to protect data or to establish secure network connections. A certificate store is the system area where certificates are kept.
To continue, click Next.
< Back
Next >
Cancel

4 Select where you would like to store the certificate and then click **Next**.

Figure 221 Certificate Import Wizard 2


Certificate Import Wizard
Certificate Store
Certificate stores are system areas where certificates are kept.
Windows can automatically select a certificate store, or you can specify a location for
Automatically select the certificate store based on the type of certificate
Place all certificates in the following store
Certificate store:
Browse...
< Back
Next >
Cancel

5 Click **Finish** to complete the **Import Certificate** wizard.

Figure 222 Certificate Import Wizard 3



6 Click **Yes** to add the Switch certificate to the root store.

Figure 223 Root Certificate Store

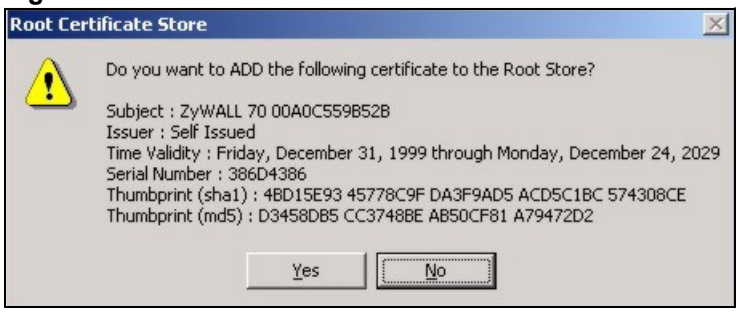

Root Certificate Store
Do you want to ADD the following certificate to the Root Store?
Subject : ZyWALL 70 00A0C559B52B
Issuer : Self Issued
Time Validity : Friday, December 31, 1999 through Monday, December 24, 2029
Serial Number : 386D4386
Thumbprint (sha1) : 4BD15E93 45778C9F DA3F9AD5 ACD5C1BC 574308CE
Thumbprint (md5) : D3458DB5 CC3748BE AB50CF81 A79472D2
Yes
No

Figure 224 Certificate General Information after Import



F

Legal Information

Copyright

Copyright © 2007 by ZyXEL Communications Corporation.

The contents of this publication may not be reproduced in any part or as a whole, transcribed, stored in a retrieval system, translated into any language, or transmitted in any form or by any means, electronic, mechanical, magnetic, optical, chemical, photocopying, manual, or otherwise, without the prior written permission of ZyXEL Communications Corporation.

Published by ZyXEL Communications Corporation. All rights reserved.

Disclaimer

ZyXEL does not assume any liability arising out of the application or use of any products, or software described herein. Neither does it convey any license under its patent rights nor the patent rights of others. ZyXEL further reserves the right to make changes in any products described herein without notice. This publication is subject to change without notice.

Trademarks

ZyNOS (ZyXEL Network Operating System) is a registered trademark of ZyXEL Communications, Inc. Other trademarks mentioned in this publication are used for identification purposes only and may be properties of their respective owners.

Certifications

Federal Communications Commission (FCC) Interference Statement

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operations.

FCC Warning

This device has been tested and found to comply with the limits for a Class A digital switch, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This device generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this device in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CE Mark Warning:

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Taiwanese BSMI (Bureau of Standards, Metrology and Inspection) A Warning:

警告使用者
這是甲類的資訊產品，在居住的環境使用時，
可能造成射頻干擾，在這種情況下，
使用者會被要求採取某些適當的對策.

Notices

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

CLASS 1 LASER PRODUCT

APPAREIL A LASER DE CLASS 1

PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11.

PRODUIT CONFORME SELON 21 CFR 1040.10 ET 1040.11.

Viewing Certifications

1. Go to http://www.zyxel.com.
2. Select your product on the ZyXEL home page to go to that product's page.
3. Select the certification you wish to view from this page.

ZyXEL Limited Warranty

ZyXEL warrants to the original end user (purchaser) that this product is free from any defects in materials or workmanship for a period of up to two years from the date of purchase. During the warranty period, and upon proof of purchase, should the product have indications of failure due to faulty workmanship and/or materials, ZyXEL will, at its discretion, repair or replace the defective products or components without charge for either parts or labor, and to whatever extent it shall deem necessary to restore the product or components to proper operating

condition. Any replacement will consist of a new or re-manufactured functionally equivalent product of equal or higher value, and will be solely at the discretion of ZyXEL. This warranty shall not apply if the product has been modified, misused, tampered with, damaged by an act of God, or subjected to abnormal working conditions.

Note

Repair or replacement, as provided under this warranty, is the exclusive remedy of the purchaser. This warranty is in lieu of all other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular use or purpose. ZyXEL shall in no event be held liable for indirect or consequential damages of any kind to the purchaser.

To obtain the services of this warranty, contact ZyXEL's Service Center for your Return Material Authorization number (RMA). Products must be returned Postage Prepaid. It is recommended that the unit be insured when shipped. Any returned products without proof of purchase or those with an out-dated warranty will be repaired or replaced (at the discretion of ZyXEL) and the customer will be billed for parts and labor. All repaired or replaced products will be shipped by ZyXEL to the corresponding return address, Postage Paid. This warranty gives you specific legal rights, and you may also have other rights that vary from country to country.

Registration

Register your product online to receive e-mail notices of firmware upgrades and information at www.zyxel.com for global products, or at www.us.zyxel.com for North American products.

G

Customer Support

Please have the following information ready when you contact customer support.

Required Information

- Product model and serial number.
- Warranty Information.
- Date that you received your device.
- Brief description of the problem and the steps you took to solve it.

"+" is the (prefix) number you dial to make an international telephone call.

Corporate Headquarters (Worldwide)

- Support E-mail: support@zyxel.com.tw
- Sales E-mail: sales@zyxel.com.tw
- Telephone: +886-3-578-3942
- Fax: +886-3-578-2439
- Web: www.zyxel.com, www.europe.zyxel.com
- FTP: ftp.zyxel.com, ftp.europe.zyxel.com
- Regular Mail: ZyXEL Communications Corp., 6 Innovation Road II, Science Park, Hsinchu 300, Taiwan

Costa Rica

- Support E-mail: soporte@zyxel.co.cr
- Sales E-mail: sales@zyxel.co.cr
- Telephone: +506-2017878
- Fax: +506-2015098
- Web: www.zyxel.co.cr
- FTP: ftp.zyxel.co.cr
- Regular Mail: ZyXEL Costa Rica, Plaza Roble Escazú, Etapa El Patio, Tercer Piso, San José, Costa Rica

Czech Republic

- E-mail: info@cz.zyxel.com
- Telephone: +420-241-091-350
- Fax: +420-241-091-359
- Web: www.zyxel.cz

- Regular Mail: ZyXEL Communications, Czech s.r.o., Modranská 621, 143 01 Praha 4 - Modrany, Ceská Republika

Denmark

- Support E-mail: support@zyxel.dk
- Sales E-mail: sales@zyxel.dk
- Telephone: +45-39-55-07-00
- Fax: +45-39-55-07-07
- Web: www.zyxel.dk
- Regular Mail: ZyXEL Communications A/S, Columbusvej, 2860 Soeborg, Denmark

Finland

- Support E-mail: support@zyxel.fi
- Sales E-mail: sales@zyxel.fi
- Telephone: +358-9-4780-8411
- Fax: +358-9-4780-8448
- Web: www.zyxel.fi
- Regular Mail: ZyXEL Communications Oy, Malminkaari 10, 00700 Helsinki, Finland

France

- E-mail: info@zyxel.fr
- Telephone: +33-4-72-52-97-97
- Fax: +33-4-72-52-19-20
- Web: www.zyxel.fr
- Regular Mail: ZyXEL France, 1 rue des Vergers, Bat. 1 / C, 69760 Limonest, France

Germany

- Support E-mail: support@zyxel.de
- Sales E-mail: sales@zyxel.de
- Telephone: +49-2405-6909-69
- Fax: +49-2405-6909-99
- Web: www.zyxel.de
- Regular Mail: ZyXEL Deutschland GmbH., Adenauerstr. 20/A2 D-52146, Wuerselen, Germany

Hungary

- Support E-mail: support@zyxel.hu
- Sales E-mail: info@zyxel.hu
- Telephone: +36-1-3361649
- Fax: +36-1-3259100
- Web: www.zyxel.hu
- Regular Mail: ZyXEL Hungary, 48, Zoldlomb Str., H-1025, Budapest, Hungary

India

- Support E-mail: support@zyxel.in
- Sales E-mail: sales@zyxel.in
- Telephone: +91-11-30888144 to +91-11-30888153
- Fax: +91-11-30888149, +91-11-26810715
- Web: http://www.zyxel.in
- Regular Mail: India - ZyXEL Technology India Pvt Ltd., II-Floor, F2/9 Okhla Phase -1, New Delhi 110020, India

Japan

- Support E-mail: support@zyxel.co.jp
- Sales E-mail: zyp@zyxel.co.jp
- Telephone: +81-3-6847-3700
- Fax: +81-3-6847-3705
- Web: www.zyxel.co.jp
- Regular Mail: ZyXEL Japan, 3F, Office T&U, 1-10-10 Higashi-Gotanda, Shinagawa-ku, Tokyo 141-0022, Japan

Kazakhstan

- Support: http://zyxel.kz/support
- Sales E-mail: sales@zyxel.kz
- Telephone: +7-3272-590-698
- Fax: +7-3272-590-689
- Web: www.zyxel.kz
- Regular Mail: ZyXEL Kazakhstan, 43 Dostyk Ave., Office 414, Dostyk Business Centre, 050010 Almaty, Republic of Kazakhstan

Malaysia

- Support E-mail: support@zyxel.com.my
- Sales E-mail: sales@zyxel.com.my
- Telephone: +603-8076-9933
- Fax: +603-8076-9833
- Web: http://www.zyxel.com.my
- Regular Mail: ZyXEL Malaysia Sdn Bhd., 1-02 & 1-03, Jalan Kenari 17F, Bandar Puchong Jaya, 47100 Puchong, Selangor Darul Ehsan, Malaysia

North America

- Support E-mail: support@zyxel.com
- Sales E-mail: sales@zyxel.com
- Telephone: +1-800-255-4101, +1-714-632-0882
- Fax: +1-714-632-0858
- Web: www.us.zyxel.com
- FTP: ftp.us.zyxel.com

- Regular Mail: ZyXEL Communications Inc., 1130 N. Miller St., Anaheim, CA 92806-2001, U.S.A.

Norway

- Support E-mail: support@zyxel.no
- Sales E-mail: sales@zyxel.no
- Telephone: +47-22-80-61-80
- Fax: +47-22-80-61-81
- Web: www.zyxel.no
- Regular Mail: ZyXEL Communications A/S, Nils Hansens vei 13, 0667 Oslo, Norway

Poland

- E-mail: info@pl.zyxel.com
- Telephone: +48-22-333 8250
- Fax: +48-22-333 8251
- Web: www.pl.zyxel.com
- Regular Mail: ZyXEL Communications, ul. Okrzei 1A, 03-715 Warszawa, Poland

Russia

- Support: http://zyxel.ru/support
- Sales E-mail: sales@zyxel.ru
- Telephone: +7-095-542-89-29
- Fax: +7-095-542-89-25
- Web: www.zyxel.ru
- Regular Mail: ZyXEL Russia, Ostrovityanova 37a Str., Moscow 117279, Russia

Singapore

- Support E-mail: support@zyxel.com.sg
- Sales E-mail: sales@zyxel.com.sg
- Telephone: +65-6899-6678
- Fax: +65-6899-8887
- Web: http://www.zyxel.com.sg
- Regular Mail: ZyXEL Singapore Pte Ltd., No. 2 International Business Park, The Strategy #03-28, Singapore 609930

Spain

- Support E-mail: support@zyxel.es
- Sales E-mail: sales@zyxel.es
- Telephone: +34-902-195-420
- Fax: +34-913-005-345
- Web: www.zyxel.es
- Regular Mail: ZyXEL Communications, Arte, 21 5ª planta, 28033 Madrid, Spain

Sweden

- Support E-mail: support@zyxel.se
- Sales E-mail: sales@zyxel.se
- Telephone: +46-31-744-7700
- Fax: +46-31-744-7701
- Web: www.zyxel.se
- Regular Mail: ZyXEL Communications A/S, Sjöporten 4, 41764 Göteborg, Sweden

Thailand

- Support E-mail: support@zyxel.co.th
- Sales E-mail: sales@zyxel.co.th
- Telephone: +662-831-5315
- Fax: +662-831-5395
- Web: http://www.zyxel.co.th
- Regular Mail: ZyXEL Thailand Co., Ltd., 1/1 Moo 2, Ratchaphruk Road, Bangrak-Noi, Muang, Nonthaburi 11000, Thailand.

Ukraine

- Support E-mail: support@ua.zyxel.com
- Sales E-mail: sales@ua.zyxel.com
- Telephone: +380-44-247-69-78
- Fax: +380-44-494-49-32
- Web: www.ua.zyxel.com
- Regular Mail: ZyXEL Ukraine, 13, Pimonenko Str., Kiev 04050, Ukraine

United Kingdom

- Support E-mail: support@zyxel.co.uk
- Sales E-mail: sales@zyxel.co.uk
- Telephone: +44-1344-303044, 08707-555779 (UK only)
- Fax: +44-1344-303034
- Web: www.zyxel.co.uk
- FTP: ftp.zyxel.co.uk
- Regular Mail: ZyXEL Communications UK Ltd., 11 The Courtyard, Eastern Road, Bracknell, Berkshire RG12 2XB, United Kingdom (UK)

Index

Numerics

802.1P priority 85

A

access control
  limitations 247
  login account 258
  remote management 265
  service port 264
  SNMP 248
accounting
  setup 192
address learning, MAC 95, 97
Address Resolution Protocol (ARP) 281, 283, 284
administrator password 259
age 123
aggregator ID 135, 136
aging time 81
alternative subnet mask notation 333
ARP
  how it works 281
  viewing 281
ARP (Address Resolution Protocol) 281
ARP inspection 201, 203
  and MAC filter 204
  configuring 204
  syslog messages 204
  trusted ports 204
authentication
  and RADIUS 188
  setup 192
authorization
  privilege levels 194
automatic VLAN registration 88

B

back up, configuration file 244
bandwidth control 293
basic settings 75
binding 201
binding table 201
  building 201
BPDUs (Bridge Protocol Data Units) 110
Bridge Protocol Data Units (BPDUs) 110
bridging 293

C

certifications 351
  notices 352
  viewing 352
CFI (Canonical Format Indicator) 87
changing the password 61
CIST 114
CIST (Common and Internal Spanning Tree) 112
Class of Service (CoS) 227
classifier 151, 153
  and QoS 151
  editing 154
  example 155
  overview 151
  setup 151, 153, 154
  viewing 154
cloning a port See port cloning 284
cluster management 273
  and switch passwords 278
  cluster manager 273, 277
  cluster member 273, 278
  cluster member firmware upgrade 276
  network example 273
  setup 276
  specification 273
  status 274
  switch models 273
  VID 277
  web configurator 275
cluster manager 273
cluster member 273
command interface 36
Common and Internal Spanning Tree (CIST) 112
Common and Internal Spanning Tree, See CIST 114
configuration 226
  change running config 243
  file names 245
configuration file 62

backup 244
restore 62, 244
saving 242
configuration, saving 61
connections
hardware 45
console port 45
settings 47
contact information 355
copying port settings, See port cloning 284
copyright 351
CPU management port 100
current date 78
current time 78
customer support 355

D

daylight saving time 79
DHCP 235
configuration options 235
modes 235
relay agent 235
relay example 240
setup 238
DHCP (Dynamic Host Configuration Protocol) 235
DHCP relay option 82 203
DHCP snooping 201
configuring 203
DHCP relay option 82 203
trusted ports 202
untrusted ports 202
DHCP snooping database 202
diagnostics 267
Ethernet port test 267
ping 267
system log 267
Differentiated Service (DiffServ) 227
DiffServ 227
activate 230
and TRTCM 231
DS field 227
DSCP 227
DSCP-to-IEEE802.1p mapping 232
network example 228
PHB 227
disclaimer 351
double-tagged frames 167
DS (Differentiated Services) 227
DSCP
DSCP-to-IEEE802.1p mapping 232
service level 227
what it does 227
DSCP (DiffServ Code Point) 227
dual personality interfaces 45
dynamic link aggregation 133

E

egress port 103
Ethernet broadcast address 281
Ethernet port test 267
Ethernet ports 47
default settings 47
external authentication server 188

F

fan speed 77
FCC interference statement 351
feature summary 58
file transfer using FTP
command example 245
filename convention, configuration 245
filtering 107
rules 107
filtering database, MAC table 279
firmware 76
upgrade 243, 276
flow control 85
back pressure 85
IEEE802.3x 85
forwarding
delay 123
frames
tagged 93
untagged 93
front panel 45
FTP 36, 245
file transfer procedure 245
restrictions over WAN 246

G

GARP 88
GARP (Generic Attribute Registration Protocol) 88
GARP terminology 88
GARP timer 81, 88

GBIC ports 34, 48
general features 293
general setup 77
getting help 64
GMT (Greenwich Mean Time) 79
GVRP 88, 93
  and port assignment 93
GVRP (GARP VLAN Registration Protocol) 88

H

hardware
  connections 45
  front panel 45
  installation precautions 42
  mounting brackets 42
  overview 45
  rack-mounting 42
  rubber feet 41
  transceivers 48, 49
hardware installation 41
hardware monitor 76
hello time 123
hops 123
HTTPS 261
  certificates 261
  implementation 261
  public keys, private keys 261
HTTPS example 262

I

IANA 338
IEEE 802.1p, priority 81
IEEE 802.1x 141
  activate 143, 144, 190, 192
  reauthentication 144
IGMP
  version 173
IGMP (Internet Group Management Protocol) 173
IGMP filtering 173
  profile 178
  profiles 175
IGMP snooping 173
  MVR 179
ingress port 103
installation
  freestanding 41
  mounting brackets 42
  precautions 42
  rack-mounting 42
  rubber feet 41
Internet Assigned Numbers Authority
  See IANA 338
IP
  capability 293
  interface 82
  services 293
  setup 82
IP source guard 201
  ARP inspection 201, 203
  DHCP snooping 201
  static bindings 201

L

LACP 133
  system priority 137
  timeout 138
layer 2 features 293
layer 3 features 293
LEDs 50
lights 50
limit MAC address learning 148
Link Aggregate Control Protocol (LACP) 133
link aggregation 133
  dynamic 133
  ID information 134
  setup 135, 136
  status 134
lockout 62
log 267
login 55
  password 61
login accounts 258
  Administrator 258
  configuring via web configurator 258
  multiple 258
  non-administrator 258
  number of 258
login password 259
loop guard 221
  how it works 222
  port shut down 223
  probe packet 222
loop guard, vs STP 221

M

MAC (Media Access Control) 76
MAC address 76, 281
  maximum number per port 148
MAC address learning 80, 95, 97, 105, 148
  specify limit 148
MAC authentication 142
  aging time 145
MAC filter
  and ARP inspection 204
MAC table 279
  how it works 279
  viewing 280
maintenance 241
  configuration backup 244
  current configuration 241
  firmware 243
  main screen 241
  restoring configuration 244
management
  port 45
Management Information Base (MIB) 248
management port 103
management specifications 294
managing the device
  good habits 37
  using FTP. See FTP.
  using SNMP. See SNMP.
  using Telnet. See command interface.
  using the command interface. See command interface.
  using the web configurator. See web configurator.
man-in-the-middle attacks 203
max
  age 123
  hops 123
MIB
  and SNMP 248
  supported MIBs 249
MIB (Management Information Base) 248
mini GBIC ports 48
  connection speed 48
  connector types 48
  transceiver installation 48
  transceiver removal 49
mini GBIC ports, see also SFP 48
mirroring ports 131
monitor port 131, 132
mounting brackets 42
MSA (MultiSource Agreement) 48
MST Instance, See MSTI 113
MST region 113
MSTI 113
  MST ID 113
MSTI (Multiple Spanning Tree Instance) 112
MSTP 109, 112
  bridge ID 125, 126
  configuration 122
  configuration digest 126
  forwarding delay 123
  Hello Time 125
  hello time 123
  Max Age 125
  max age 123
  max hops 123
  MST region 113
  network example 112
  path cost 124
  port priority 124
  revision level 123
MSTP (Multiple Spanning Tree Protocol) 109
MTU (Multi-Tenant Unit) 79
multicast 173
  802.1 priority 175
  and IGMP 173
  IP addresses 173
  overview 173
  setup 174, 175
multicast group 178
multicast VLAN 182
Multiple Spanning Tree Instance, See MSTI 112
Multiple Spanning Tree Protocol 111
Multiple Spanning Tree Protocol, See MSTP. 109
Multiple STP 111
Multiple STP, see MSTP 112
MVR 179
  configuration 180
  group configuration 182
  network example 179
MVR (Multicast VLAN Registration) 179

N

NAT 338
network management system (NMS) 248
NTP (RFC-1305) 78

P

password 61
  administrator 259
PHB (Per-Hop Behavior) 227

ping, test connection 267
policy 159, 160
and classifier 159
and DiffServ 157
configuration 159
example 161
overview 157
rules 157, 158
viewing 160
policy configuration 160
port authentication 141
and RADIUS 188
IEEE802.1x 143, 144, 190, 192
MAC authentication 142
port based VLAN type 80
port cloning 283, 284
advanced settings 283, 284
basic settings 283, 284
port details 70
port isolation 93, 103
port mirroring 131, 132, 293
direction 132
egress 132
ingress 132
port redundancy 133
port security 147
address learning 148
limit MAC address learning 148
MAC address learning 147
overview 147
setup 147, 223
port setup 84
port status 69
port VLAN trunking 89
port-based VLAN 100
all connected 103
port isolation 103
settings wizard 103
ports
“standby” 133
diagnostics 267
GBIC 34
mirroring 131
speed/duplex 85
power
voltage 77
power status 77
priority level 81
priority queue assignment 81
priority, queue assignment 81
product registration 353
Product specification 291
protocol based VLAN 96
and IEEE 802.1Q tagging 96
example 99
hexadecimal notation for protocols 95, 98
isolate traffic 96
priority 95, 98
PVID 87, 93
PVID (Priority Frame) 87

Q

QoS 293
and classifier 151
queue weight 164
queuing 163
SPQ 164
WFQ 164
WRR 164
queuing method 163, 165

R

rack-mounting 42
RADIUS 188
advantages 188
and authentication 188
Network example 187
server 188
settings 188
setup 188
Rapid Spanning Tree Protocol, See RSTP. 109
reboot
load configuration 243
reboot system 243
registration
product 353
related documentation 3
remote management 265
service 266
trusted computers 265
resetting 62, 242
to factory default settings 242
restoring configuration 62, 244
RFC 3164 269
Round Robin Scheduling 164
routing protocols 293
RSTP 109
rubber feet
installation 41

S

safety warnings 6
save configuration 61, 242
screen summary 58
Secure Shell See SSH 260
security 293
service access control 264
  service port 265
SFP (Small Form-Factor Pluggable), see also mini GBIC 48
Simple Network Management Protocol, see SNMP 248
SNMP 37, 248
  agent 248
  and MIB 248
  authentication 257
  communities 256
  management model 248
  manager 248
  MIB 249
  network components 248
  object variables 248
  protocol operations 248
  security 257
  setup 255
  traps 257
  version 3 and security 249
  versions supported 248
SNMP traps 249
  supported 249, 250, 252, 254
Spanning Tree Protocol, See STP. 109
SPQ (Strict Priority Queuing) 164
SSH
  encryption methods 261
  how it works 260
  implementation 261
SSH (Secure Shell) 260
SSL (Secure Socket Layer) 261
standby ports 133
static bindings 201
static MAC address 105
static MAC forwarding 95, 97, 105
static routes 225, 226
static trunking example 138
static VLAN 91
  control 92
  tagging 92
status 56, 69
  LED 50
  link aggregation 134
  port 69
  port details 70
  power 77
  STP 117, 120, 124
  VLAN 90
status lights 50
STP 109, 293
  bridge ID 118, 121
  bridge priority 116, 119
  configuration 116, 119, 122
  designated bridge 110
  forwarding delay 117, 120
  Hello BPDU 110
  Hello Time 117, 118, 120, 121
  how it works 110
  Max Age 117, 118, 120, 121
  path cost 110, 117, 120
  port priority 117, 120
  port state 111
  root port 110
  status 117, 120, 124
  terminology 109
  vs loop guard 221
subnet 331
subnet based VLANs 94
  and DHCP VLAN 95
  and priority 94
  configuration 95
subnet mask 332
subnetting 334
switch lockout 62
switch reset 62
switch setup 80
switching 293
syntax conventions 4
syslog 204, 269
  protocol 269
  server setup 270
  settings 269
  setup 269
  severity levels 269
system information 75
system log 267
system reboot 243

T

TACACS+ 188
  setup 190
TACACS+ (Terminal Access Controller Access-Control System Plus) 187
tagged VLAN 87
temperature indicator 77
time
  current 78

time zone 79
Time (RFC-868) 78
time server 78
time service protocol 78
format 78
trademarks 351
transceiver
installation 48
removal 49
traps
destination 256
TRTCM
and bandwidth control 231
and DiffServ 231
color-aware mode 229
color-blind mode 229
setup 230
trunk group 133
trunking 133, 293
example 138
trusted ports
ARP inspection 204
DHCP snooping 202
Tunnel Protocol Attribute, and RADIUS 196
Two Rate Three Color Marker (TRTCM) 228
Two Rate Three Color Marker, see TRTCM 228
Type of Service (ToS) 227

U

untrusted ports
ARP inspection 204
DHCP snooping 202
user profiles 187

V

Vendor Specific Attribute, See VSA 195
ventilation 42
ventilation holes
hardware 42
VID 87, 90, 91, 169
number of possible VIDs 87
priority frame 87
VID (VLAN Identifier) 87
VLAN 79, 87, 293
acceptable frame type 93
automatic registration 88
ID 87
ingress filtering 93
introduction 79
number of VLANs 90
port isolation 93
port number 91
port settings 92
port-based VLAN 100
port-based, all connected 103
port-based, isolation 103
port-based, wizard 103
static VLAN 91
status 90, 91
tagged 87
trunking 89, 94
type 80, 89
VLAN (Virtual Local Area Network) 79
VLAN stacking 167, 169
configuration 170
example 167
frame format 169
port roles 168, 171
priority 169
VLAN, protocol based, See protocol based VLAN 96
VLAN, subnet based, See subnet based VLANs 94
VSA 195

W

warning lights 50
warranty 352
note 353
web configurator 36, 55
getting help 64
home 56
login 55
logout 63
navigation panel 57
screen summary 58
weight, queuing 164
Weighted Round Robin Scheduling (WRR) 164
WFQ (Weighted Fair Queuing) 164
WRR (Weighted Round Robin Scheduling 164

Z

ZyNOS (ZyXEL Network Operating System) 245